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Fiscal Year Ended June 30, 1959

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CHIEF OF ENGINEERS

U.S. ARMY, Corps of Engineers

ON CIVIL WORKS ACTIVITIES

1959

IN TWO VOLUMES

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Volume 2

Reports on individual project operations and related civil works activities published as a separate volume.

SUBJECT: Annual Report on Civil Works Activities for Fiscal Year 1959.

TO: THE SECRETARY OF THE ARMY.

1. The water resource development activities of the Corps of Engineers include the investigation, planning, funding, construction, maintenance, and operation of works for navigation and flood control, including the multiple-purpose water resource developments associated therewith, as authorized by law. The first volume of my report gives a brief description of these activities and of the accomplishments of the program. The second volume sets forth detailed fiscal, engineering, and statistical data.

2. The present active civil works program, consisting of more than 3,300 project authorizations, has a total estimated cost of about \$18.2 billion. Appropriations through fiscal year 1959 for that work total about \$8.6 billion, leaving about \$9.6 billion still required. Expenditures during the year were \$796 million, of which \$661 million (83 percent) was for construction and \$135 million (17 percent) was for maintenance and operation.

3. *Construction.* For the entire program—navigation, shore protection, flood control, and Mississippi River and tributaries—construction was initiated on 54 new projects. Construction operations were carried out on 256 additional projects. A total of 66 projects was placed in effective operation. The highlights are as follows:

(a) *Navigation.* Construction was initiated on the navigation lock at the Old River, La., Pike Island, Ohio, and Columbia, Ala., locks and dams, as well as on dam 27 at Chain of Rocks on the Mississippi at St. Louis. The Hildebrand lock and dam in West Virginia was placed in useful operation.

(b) *Flood Control.* In March 1959 construction was initiated on the large and complex St. Louis flood control project. Six flood control reservoirs were placed in useful operation. They are Dyberry, Pa., Ferrells Bridge, Tex., Hodges Village, Mass., Rough River, Ky., San Lorenzo, Calif., and Toronto, Kans.

(c) *Multiple-Purpose Reservoirs With Power.* Construction was initiated on the Big Bend project on the Missouri River. The Table Rock project on the White River in Arkansas and Missouri began initial generation of power.

4. *Accomplishments of the Program.*

(a) *Navigation.* Waterborne commerce of the United States and possessions during calendar year 1958 amounted to 1,005 million tons, of which 50 percent, 13 percent, and 37 percent was coastal, Great Lakes, and inland, respectively. Traffic on the Great Lakes amounted to 80 billion ton-miles, and on the inland waterway system 110 billion ton-miles. A slackening of industrial activity in 1958 was reflected in a relatively small decrease in traffic for all three elements.

(b) *Flood Control.* Large-scale benefits have accrued to the Nation as a result of the Federal flood control program. Flood damage prevented by Corps of Engineers projects in useful operation is estimated to total \$9.2 billion through June 30, 1959, including \$194 million during fiscal year 1959.

(c) *Power.* The generating capacity of the 32 projects now in operation, 6.1 million kilowatts, represents 20 percent of the national hydroelectric capacity, or 4 percent of the total generating capacity, of the Nation's utility systems. The 26.8 billion net kilowatt-hours of energy generated at Corps of Engineers projects represents 20 percent of the hydroelectric energy produced and 3.9 percent of the total electric energy produced by the Nation's utility systems.

(d) *Water Supply.* The Corps is now providing almost 1.5 million acre-feet of storage for water supply in 19 reservoirs serving about 40 cities. Some 4 million acre-feet of storage space is being utilized, either exclusively for irrigation, or jointly for irrigation and other purposes. In addition, large quantities of water made available by power releases and evacuation of flood control storage improve the quantity and quality of downstream flows.

(e) *Recreational Use.* Both reservoirs and navigation projects furnish excellent opportunities for public recreation and make available approximately 3 million acres of reservoir water surface at normal pool levels. A majority of the public recreational services is provided at the expense of State and other local agencies. Attendance at Corps of Engineers' projects was 95 million during calendar year 1958, an increase of nearly 600 percent since 1950. Youth camps now have a capacity for some 30,000 campers.

5. *Floods During the Year.* Despite the flood control accomplishments mentioned above, much remains to be done. Major flooding occurred in the Gulf and South Atlantic region and in the Missouri and Ohio Basins. For example, floods in Iowa in July 1958 claimed 19 lives, and floods in Pennsylvania and West Virginia in July and August 1958 took 11 lives. Estimates indicate that in the Ohio Basin from Illinois to New York, in January and February 1959, about

\$100 million in flood damage was sustained and about \$120 million in damage prevented.

6. *Investigations and Authorizations.* The investigation program of the Corps provides a basis for sound development of the Nation's water resources and long-range planning to meet future needs. During the year 65 reports were transmitted to Congress. The River and Harbor, Flood Control, and Water Supply Act of 1958 (Public Law 85-500), approved July 3, 1958, increased basin monetary authorizations by \$608 million and authorized 139 additional projects, including the first 3 hurricane-flood protection projects, having an estimated Federal cost of \$748 million.

7. *Basic Policies and Agreements of Major Scope.*

(a) Enactment of the Fish and Wildlife Coordination Act (Public Law 85-624, Aug. 12, 1958) authorized inclusion of improvements for preservation and enhancement of wildlife, fish, and game resources.

(b) The Interagency Committee on Water Resources brought up to date the publication titled "Proposed Practice for Economic Analysis of River Basin Projects."

(c) An agreement was reached with the Soil Conservation Service on a division of responsibilities in connection with protection of rural and urban areas by local protection works and reservoirs.

(d) The Water Supply Act of 1958 broadened authority for water supply storage in reservoir projects to meet long-range future needs.

8. Fiscal year 1959 has been a year of substantial accomplishments. Material progress was made in furthering coordination in project development and project planning and design with various Federal, State, and other agencies. The planned comprehensive approach being made for the control of floods and the development of our water resources is sound and in the public interest. Such a broad and long-term approach is essential to continued economic growth.

E. C. ITSCHNER
Lieutenant General, USA
Chief of Engineers

10-YEAR HIGHLIGHTS—CORPS OF ENGINEERS WATER RESOURCES DEVELOPMENT

Classification	Appropriations cumulative through 1959	1959	1958	1957	1956	1955	1954	1953	1952	1951	1950	Cumulative 1824 through 1949
I. APPROPRIATIONS—ACTIVE PROGRAM (\$ millions) (fiscal year).....		816	639	639	612	444	426	562	617	619	641	-----
II. APPROPRIATIONS (\$ millions)*:												
A. Navigation.....	2,407	190	141	134	88	42	25	31	47	48	60	1,601
B. Flood Control.....	3,246	278	226	212	143	91	82	148	151	173	231	1,511
C. Multiple-purpose Including Power.....	2,952	190	126	157	212	204	207	272	278	296	240	770
D. Beach Erosion Control.....	6	1	-----	1	3	-----	-----	-----	1	-----	-----	-----
E. Total.....	8,611	659	493	504	446	337	314	451	477	517	531	3,882
III. NAVIGATION (calendar year):												
A. Total (tons—billions).....	-----	-----	1,005	1,131	1,093	1,016	0,868	0,924	0,888	0,924	0,821	-----
B. Great Lakes (ton-miles—billions).....	-----	-----	80	117	111	119	91	127	105	120	112	-----
C. Inland (ton-miles—billions).....	-----	-----	110	115	109	98	83	75	64	62	52	-----
D. Total of B and C.....	-----	-----	190	232	220	217	174	202	169	182	164	-----
IV. FLOOD DAMAGES PREVENTED (\$ billions) (cumulative).....		9.2	9.0	8.7	8.2	7.8	7.3	6.6	6.0	5.3	4.9	4.6
V. POWER:												
A. Installed (kw millions) (cumulative).....	-----	6.1	5.6	4.8	4.0	3.2	2.5	1.7	1.2	1.0	0.8	0.7
B. Generated (kwh billions) (fiscal year).....	-----	26.8	27.2	22.6	18.1	12.6	8.9	6.9	7.1	5.2	4.7	29.9
VI. OTHER RELATED USES:												
A. Water supply and irrigation storage (cumulative) (million acre-feet).....	-----	5.5	5.2	5.0	5.0	4.9	4.2	2.7	2.0	1.0	1.0	0.8
B. Visitor-days (millions) (calendar year).....	-----	-----	95	85	71	63	54	41	30	21	16	20
VII. RESERVOIR STORAGE (cumulative) (million acre-feet).....		155	153	150	144	120	115	87	74	60	57	-----

*New work, active program only. Excludes about \$506 million expended on superseded projects.

CHAPTER I

A PROGRAM FOR WATER RESOURCES DEVELOPMENT

1. SCOPE OF THE PROGRAM

The civil works program of the Corps of Engineers constitutes a major portion of the Federal plan for developing and using the Nation's water resources. From a modest beginning, the program has been enlarged to meet the continually growing demands of an expanding population and economy for water uses.

Beginning with a \$75,000 appropriation in 1824 for snagging and clearing the Mississippi and Ohio Rivers, the program has grown until it constitutes a multimillion-dollar activity, with about 3,300 projects in the 50 States, the District of Columbia, and possessions. The work embraces projects for the improvement of the Nation's rivers and harbors for navigation, flood control, hydropower, and related purposes.

Navigation improvements at coastal and Great Lakes harbors generally involve the dredging of channels and anchorages, and frequently the protection of entrances by jetties and the creation of protected areas by breakwaters. Rivers are improved for navigation by dredging, regulating works, and canalization by locks and dams. Flood control is accomplished by increasing the carrying capacity of streams, by diversion channels, by reservoirs for storage of flood flows, and by levees and floodwalls. Projects for beach erosion control entail principally the restoration of damaged areas by artificial placement of sandfill and construction of seawalls, groins, and similar structures.

The program involving development of our major rivers has naturally afforded large possibilities for conservation and use of water resources. Reservoirs often provide for the development of hydroelectric power, for storage of water for industrial, municipal, and agricultural use, and for improvement of low-water flows. In many cases the projects also provide large public recreational values and opportunities for preservation and enhancement of fish and wildlife resources. These collateral functions have become increasingly important in serving an expanding economy. Congress has always specified the areas to be investigated, prescribed the policies to be fol-

lowed, and defined the limits of Federal participation. Congress authorizes projects individually, and assigns responsibility for their construction and administration to the Secretary of the Army and the Chief of Engineers.

2. STATUS OF PROGRAM

Federal activity in providing navigation improvements dates back to the first River and Harbor Act, passed in 1824. The major growth of the water resources program has occurred since 1928, when Congress adopted the project for flood control and navigation in the alluvial valley of the Mississippi and, particularly, since 1936 when Federal participation in flood control on a nationwide basis was first authorized.

As a result of successive congressional authorizations, the program as of June 30, 1959, includes improvements completed, under construction, and not started, with an estimated cost of \$21.0 billion. This program includes certain projects which, because of changes in economic and physical conditions, are no longer required, have been classified as inactive, as well as other projects which require further study. Projects in these two categories have an estimated cost of about \$2.8 billion, leaving an active program with an estimated cost of about \$18.2 billion. This program is being subjected to continuing review and will be adjusted from year to year as warranted by changed conditions. The status of the active program, as of June 30, 1959, was as follows:

Active Civil Works Program

Status	Number of projects or project authorizations	Estimated cost, 1959	Appropriations through fiscal year 1959	Required to complete
		<i>(Millions of dollars)</i>		
Completed or substantially completed.....	2, 517	3, 580	3, 548	32
Under construction.....	417	9, 742	5, 033	4, 709
Authorized, not started.....	401	4, 906	30	4, 876
Total.....	3, 335	18, 228	8, 611	9, 617

The backlog of active authorized work consists of those projects for which there is a current need and justification, such as the flood control work needed to protect areas where there is danger to life or possibility of heavy economic loss, navigation improvements required by a rapidly expanding economy, and hydroelectric power and water supply developments in conjunction with flood control and navigation.

3. ORGANIZATION

The civil works mission of the Corps of Engineers is accomplished through a highly decentralized organization consistent with the wide geographic spread of authorized activities. This organization is comprised of 11 divisions which are subdivided into 40 districts completely covering the continental United States, territories, and oversea possessions. Boundaries between divisions and districts are selected so as to place, to the extent practicable, a river basin or appropriate coastal area within a single division and district, although in major basins this delineation is not always feasible.

The divisions and districts are administered by officers of the Corps of Engineers directing the work of about 27,000 civilians, exclusive of contractors' personnel, engaged in the planning, supervision of construction, and operation of civil works. These field offices, together with certain additional division and district offices, also handle the military construction programs of the Army and the major portion of the Air Force program.

CHAPTER II

PROJECT CONSTRUCTION AND OPERATIONS PROGRESS

The civil works program of the Corps of Engineers comprising navigation, flood control and multiple-purpose projects, and various related activities, was diligently prosecuted during the fiscal year. Notable progress was made in carrying out project construction and placing additional works in useful operation. Construction was initiated on 54 new projects and on new features at 5 Mississippi River flood-control projects. Also, construction operations were carried out on 268 additional projects. Sixty-seven projects including features at three Mississippi River flood-control projects and at nine multiple-purpose projects were placed in effective operation. A summary of project construction and operations by classes follows:

1. NAVIGATION

The present program for rivers and harbors as specifically authorized by the Congress includes projects located throughout the United States and insular possessions. These projects are of various types; deep-draft harbors accommodating oceangoing vessels, shallow-draft channels for general small-boat navigation, inland waterways for commercial barge navigation, and the Great Lakes harbors and connecting waterways.

Construction. During the fiscal year 1959 active construction operations were carried out on 110 navigation projects, of which 36 were placed in useful operation as shown in table 1.

In the fiscal year 1959, work was initiated on 30 navigation projects listed in table 2.

The 44 navigation projects having major construction activity underway at the close of the fiscal year, exclusive of the 30 new starts listed in table 2, are shown in table 3.

Maintenance. Maintenance and operation activities were conducted on 233 navigation projects during the fiscal year at a cost of \$77,386,754. In addition, costs of \$3,964,331 were incurred on activities for the protection of navigation and surveys of northern and northwestern lakes. In allocating the funds being provided for project maintenance, every effort consistent with budgetary requirements is made to maintain navigation projects adequately to serve the rea-

sonable requirements of commerce and navigation. Accomplishment of this work was principally confined to deep-draft harbors and major inland waterways, and for those relatively few channels serving areas where hardship to the locality would result from nonmaintenance.

Table 1. Navigation Improvements Placed in Useful Operation During Fiscal Year 1959

Project	Date started	Date placed in useful operation	Nature of improvement
Isle Au Haut Thoroughfare, Maine	Aug 58	Sep 58	Rock removal.
Cape Cod Canal (Onset Bay), Mass.	May 57	Jun 59	Dredging.
Gloucester Harbor (Lobster Cove), Mass.	Sep 58	Nov 58	Do.
Newburyport Harbor, Mass.	Nov 57	Aug 58	Do.
Bullocks Point Cove, R.I.	May 58	Feb 59	Dredging and break-water.
East River, N.Y.	Mar 59	Mar 59	Dredging and rock removal.
Great South Bay, N.Y.	Apr 58	Jul 58	Dredging.
Jones Inlet, N.Y.	Jul 53	Jun 59	Dredging and jetty.
Cambridge Harbor, Md.	May 58	Aug 58	Dredging.
Waterway on coast of Virginia	Jul 56	Oct 58	Do.
Norfolk Harbor, Va. (Southern Branch).	Oct 58	do	Do.
Atlantic Intracoastal Waterway, N.C. (Masonboro Inlet Channel).	Apr 59	Jun 59	Do.
Wallace Channel (Pamlico Sound), N.C.	Jul 58	Aug 58	Dredging outer channel.
Savannah Harbor, Ga.	Apr 58	Dec 58	Dredging.
Anclote River, Fla.	Jun 58	Jul 58	Do.
Horseshoe Cove, Fla.	do	May 59	Do.
Charlotte Harbor, Fla.	Nov 58	do	Do.
Biloxi Harbor (Cranes Neck), Miss.	Jul 58	Jul 58	Do.
Pass Christian Harbor, Miss.	Apr 59	Jun 59	Do.
Chefuncte River and Bogue Failia, La.	Mar 59	Apr 59	Do.
Hildebrand Lock and Dam, Monongahela River, W. Va.	Apr 56	Jun 59	Replacement for existing locks and dams 12 and 13.
Lansing Harbor, Iowa	Sep 58	Dec 58	Small boat harbor.
Eagle Harbor, Mich.	Aug 58	Jun 59	Do.
Prairie du Chien Harbor, Wis.	do	Oct 58	Dredging.
Hannibal Harbor, Mo.	do	Dec 58	Small boat harbor.
Cheboygan Harbor, Mich.	May 57	May 59	Dredging.
Erie Harbor, Pa.	May 58	Aug 58	Widen 25-foot approach channel to ore dock.

Table 1. Navigation Improvements Placed in Useful Operation During Fiscal Year 1959—Continued

Project	Date started	Date placed in useful operation	Nature of improvement
Black Rock Channel and Tonawanda Harbor, N.Y.	Aug 58	Dec 58	Widen entrance to Black Rock Canal.
Everett Harbor and Snohomish River, Wash.	Apr 57	Jul 58	Dredging and Breakwater.
Willapa River and Harbor and Naselle River, Wash.	Jul 57	Nov 58	Do.
Columbia River between Chinook and head of Sand Island, Oreg. and Wash.	Apr 58	Sep 58	Boat basin and breakwater at Chinook.
Tillamook Bay and Bar, Oreg.-----	May 58	Aug 58	Garibaldi boat basin.
Ketchikan Harbor, Alaska-----	Nov 57	Nov 58	Dredging.
Skagway Harbor, Alaska-----	Apr 59	May 59	Do.
Kawaihae Harbor, Hawaii-----	Jan 57	Jun 59	Dredging and breakwater.
Nawiliwili Harbor, Hawaii-----	Dec 55	Mar 59	Dredging.

Table 2. Navigation Improvements Initiated During Fiscal Year 1959

Project	Date started	Scheduled completion date	Nature of improvement
Duxbury Harbor, Mass.-----	Jun 59	Jan 60	Dredging.
Hyannis Harbor, Mass.-----	May 59	---do---	Do.
Salem Harbor, Mass.-----	---do---	Jun 60	Do.
Scituate Harbor, Mass.-----	Jun 59	Jul 59	Do.
Savannah River below Augusta, Ga.: Channel cutoff-----	Oct 58	Jun 61	Do.
Dikes and revetments-----	Sep 58	---do---	Construction of pile dikes and bank revetment.
Brunswick Harbor, Ga.-----	Apr 59	Mar 60	Dredging.
Hillsboro River (Tampa Harbor), Fla.	Jun 59	---do---	Do.
Port St. Joe Harbor, Fla.-----	Apr 59	---do---	Do.
Aquatic Plant Control, La. and Fla.	May 59	Jun 64	Aquatic plant control.
Dauphin Island Bay (Fort Gaines Channel), Ala.	Apr 59	Jul 59	Dredging.
Matagorda Ship Channel, Tex. (Port Lavaca).	May 59	Nov 59	Do.
Texas City Channel, Tex.-----	Apr 59	Jan 60	Do.
Pike Island Locks and Dam, Ohio River.	May 59	Jun 64	Replacement for existing locks and dams 10 and 11.

Table 2. *Navigation Improvements Initiated During Fiscal Year 1959—Con.*

Project	Date started	Scheduled completion date	Nature of improvement
Dam No. 27, Mississippi River-----	Feb 59	Feb 62	Canalization.
Lac La Belle Harbor, Mich-----	Jan 59	Dec 59	Small boat harbor.
Grand Marais Harbor, Minn-----	Jun 59	---do---	Do.
Mississippi River at Quincy, Ill----	May 59	Jun 62	Bridge alteration.
Kenosha Harbor, Wis-----	Jul 58	Dec 59	Channel improvements and relocations.
St. Clair River, Mich-----	Sep 58	Jun 62	Dredging.
Harrisville Harbor, Mich-----	Jul 58	Sep 59	Dredging and breakwater.
Buffalo Harbor (North Entrance Channel and Buffalo River), N.Y.	Apr 59	Feb 62	Dredging.
Port Hueneme Harbor, Calif-----	Feb 59	Jun 61	Dredging and jetties.
Halfmoon Bay Harbor, Calif-----	Mar 59	Sep 61	Breakwaters.
Port Angeles Harbor, Wash-----	Jul 58	Aug 59	Dredging and breakwaters.
Columbia Lock and Dam, Chattahoochee River, Ga. and Fla.	Mar 59	Dec 63	Construction of lock and dam.
Rogue River Harbor, Gold Beach, Oreg.	Jun 59	Jul 61	Dredging and jetties.
Dry Pass, Alaska-----	Nov 58	Sep 59	Dredging.
Neva Strait, Alaska-----	Jun 59	---do---	Do.
Honolulu Harbor, Hawaii (2d Entrance Channel).	---do---	Mar 61	Dredging and bridge construction.

Table 3. *Other Navigation Improvements Under Construction June 30, 1959*

Project	Date started	Scheduled completion date	Nature of improvement
Boston Harbor, Mass-----	Nov 56	Jan 60	Dredging anchorage.
Weymouth-Fore River, Mass-----	Jun 58	Mar 61	Dredging.
New York and New Jersey Channel, N.Y. and N.J.	Oct 53	Nov 59	Dredging and rock removal (middle section).
Great Lakes to Hudson River Waterway, N.Y.	Sep 53	Jun 64	Dredging, raising locks and bridges.
Delaware River between Philadelphia, Pa., and Trenton, N.J.	Jul 56	---do---	Dredging and bridge reconstruction.
Inland Waterway, Delaware River to Chesapeake Bay, Del. and Md.	May 57	Mar 60	Summit bridge.
Norfolk Harbor, Va-----	Oct 57	Jun 60	Widen 40-foot channel.

Table 3. *Other Navigation Improvements Under Construction June 30, 1959—*
Continued

Project	Date started	Scheduled completion date	Nature of improvement
IWW, Jacksonville to Miami, Fla.— Eau Gallie to Fort Pierce.	Apr 57	Apr. 60	Dredging.
Tampa Harbor, Fla.-----	Nov 55	Sep 61	Do.
Black Warrior, Warrior and Tombigee Rivers, Ala.	Oct 56	Jun 61	Construction of Jackson lock and dam.
Gulf Intracoastal Waterway:			
1. Algiers Alternate Connection.	May 47	---do---	Construction and dredging.
2. Port Allen Lock and Canal (Plaquemine—Morgan City Alt).	Feb 55	---do---	Do.
Mississippi River—Gulf Outlet, La.	Mar 58	Jun 67	Do.
Arkansas River and tributaries, Ark., Okla.	May 50	Jun 66	Bank stabilization.
Mississippi River between Ohio and Missouri Rivers.	1881	After 1969	Regulating works.
Brazos Island Harbor, Tex., 36-foot project.	Jan 57	Jun 61	Dredging.
Houston Ship Channel, Tex., 36-foot project.	Jun 50	Nov 60	Do.
Port Aransas-Corpus Christi Waterway, Tex., 36-foot project.	Jul 56	Feb 62	Do.
Sabine-Neches Waterway, Tex., channel rectification.	Apr 57	Oct 64	Do.
Galveston Harbor and Channel, Tex.	May 58	Jun 62	Seawall construction.
Gulf Intracoastal Waterway:			
1. Guadalupe River, Channel to Victoria, Tex.	---do---	Jan 65	Dredging.
2. Realignment vicinity, Aransas Pass, Tex.	---do---	Jun 60	Dredging and highway bridge construction.
Missouri River, Kansas City to Mouth, Mo.	1912	After 1962	Bank stabilization.
Missouri River, Kansas City to Sioux City, Iowa.	1928	After 1968	Do.
Greenup Locks and Dam, Ohio River.	Sep 54	May 61	Replacement for existing locks and dams 27-30, inclusive.
Markland Locks and Dam, Ohio River.	May 56	Mar 62	Replacement of existing locks and dams 35-39, inclusive.
New Cumberland Locks and Dam, Ohio River.	Apr 55	Jun 61	Replacement for existing locks.

Table 3. Other Navigation Improvements Under Construction June 30, 1959—
Continued

Project	Date started	Scheduled completion date	Nature of improvement
Locks and Dam 41, Ohio River----	Aug 56	Jun 63	Reconstruction of locks and dam 41.
Captain Anthony Meldahl Locks and Dam (New Richmond Locks and Dam), Ohio River.	Apr 58	Dec 63	Replacement for existing locks and dams 31-34, inclusive.
Dam 8, Monongahela River-----	---do---	Jan 60	Raise crest of dam.
St. Anthony Falls, Minn-----	Aug 48	FY 1963	Lock and dam construction and dredging.
Calumet-Sag Modification to Illinois Waterway, Ill. and Ind.	Nov 55	Jun 64	Channel improvement, bridge relocations and dredging.
St. Marys River, Mich-----	Jul 57	Jun 63	Dredging.
Detroit River, Mich-----	May 57	Nov 62	Do.
Whitefish Point Harbor, Mich----	Aug 56	Nov 59	Dredging and breakwater.
Port Austin Harbor, Mich-----	Apr 58	Jul 59	Do.
St. Marys River, Bridge Island, Mich.	Dec 57	Apr 60	Replacement of railroad bridge.
Cleveland Harbor, Ohio-----	Jul 50	Jun 61	Dredging Cuyahoga River and replacement of railroad bridges.
Ashtabula Harbor, Ohio-----	Oct 55	Nov 59	Deepening of east outer harbor.
Barcelona Harbor, N.Y-----	May 58	Jun 60	Dredging and breakwater.
Oswego Harbor, N.Y-----	May 57	---do---	Breakwater.
San Diego River and Mission Bay, Calif.	Apr 48	Aug 59	Dredging and jetties.
Playa del Ray Inlet and Harbor, Venice, Calif.	Feb 58	May 61	Small boat harbor.
Sacramento River Deep Water Ship Channel, Calif.	Jul 49	Jun 63	Dredging and construction.
San Joaquin River—Stockton Deep Water Channel, Calif.	Feb 55	After 1966	Do.
Quillayute River, Wash-----	May 57	Jun 60	Dredging and breakwater.

2. SHORE PROTECTION

The policy of Federal assistance in the construction of works for the restoration and protection against erosion by waves and currents applies to shores of the United States and possessions, that are owned by States, municipalities, or other political subdivisions, and also to shores other than public if there is a benefit such as that arising from public use or from the protection of nearby public property or if the benefits to those shores are incidental to the project. Construction of a project is accomplished by local interests or by the Government by mutual agreement.

During fiscal year 1959, construction operations were carried out on nine shore-protection projects as shown in table 4.

Table 4. Shore Protection Projects

Project	Date started	Date placed in useful operation	Scheduled completion date	Nature of improvement
Winthrop Beach, Mass----	Sep 49	Mar 59	-----	Groins, seawall, and beach replenishment.
Calf Pasture Beach, Conn--	Sep 58	Dec 58	-----	Sand fill and groins.
Compo Beach, Conn-----	Oct 58	Apr 59	-----	Groins and beach replenishment.
Cove Island Beach, Conn--	Jul 58	Sep 58	-----	Sand fill and jetty.
Sasco Hill Beach, Conn----	Jun 58	Jul 58	-----	Groin and beach replenishment.
Southport Beach, Fairfield, Conn.	---do---	---do---	-----	Do.
Guilford Point (Jacob's Beach), Conn.	Jun 59	-----	Jul 59	Sand fill.
Fire Island Inlet, N.Y. (Long Island).	Apr 59	-----	Jun 70	Beach replenishment.
Atlantic City, N.J-----	1948	-----	After 1961	Jetties, groins, beach replenishment.

3. GENERAL FLOOD CONTROL

The general statutory background and broad description of the authorized flood control general program and the program for the Sacramento River, Calif., were discussed on pages 4 through 9 of part 1, volume 1, of the Annual Report of the Chief of Engineers for 1953. Additional authorizations through fiscal year 1958 are described on page 15, volume 1, of the Annual Report of the Chief of Engineers for 1956; on page 11, volume 1, of the Annual Report of the Chief of Engineers for fiscal year 1957, and on pages 13 and 14, volume 1, of the Annual Report of the Chief of Engineers for fiscal year 1958.

Construction. During fiscal year 1959 active construction operations were carried out on 113 specifically authorized flood control projects, of which 11 were fully completed, and an additional 19 were completed for beneficial use as shown in table 5.

Table 5. Flood-Control Projects Placed in Useful Operation During Fiscal Year 1959

Project	Date started	Date placed in useful operation	Nature of project
Adams, Mass.....	Jun 50	Jul 58	Local protection.
Barbourville, Ky.....	Jun 55	Nov 58	Do.
Cálon, Ark.....	Jun 57	Mar 59	Do.
Catlettsburg, Ky.....	Apr 58	May 59	Do.
Conway County Drainage and Levee District No. 1, Arkansas River, Ark.	Jul 58	Nov 58	Do.
Dyberry, Pa.....	Apr 57	Jun 59	Reservoir.
Ferrells Bridge, Tex.....	Jan 55	do	Do.
Greybull, Wyo.....	Jun 58	do	Local protection.
Hodges Village, Mass.....	Apr 58	do	Reservoir.
Mandan, N. Dak.....	Jul 49	do	Local protection.
Maniece Bayou, Ark.....	Jan 58	Apr 59	Do.
Norwich Channel Improvement, Connecticut.	Jun 47	Dec 58	Channel improvement.
Rough River, Ky.....	Nov 55	Jun 59	Reservoir.
Russian River (Coyote Valley Reservoir), Calif.	May 56	do	Reservoir and channel.
San Lorenzo River, Calif.....	Oct 57	do	Local protection.
Toronto, Kans.....	Nov 54	do	Reservoir.
Upper Iowa River, Iowa.....	Mar 57	May 59	Channel improvement.
Waterbury, Vt.....	Sep 56	Nov 58	Dam modification.
Wrightsville, Vt.....	Oct 56	Sep 58	Do.

During the year, work on 23 specifically authorized flood control projects exclusive of multiple-purpose projects was initiated as shown in table 6.

Table 6. Flood-Control Projects Initiated During Fiscal Year 1959

Project	Date started	Scheduled completion date	Nature of project
Allentown, Pa.....	Sep 58	1960	Local protection.
Carbon Canyon, Calif.....	May 59	1960	Reservoir.
Coal Creek (Lake City), Tenn.....	Apr 59	1959	Local protection.
Eel River (Sandy Prairie), Calif.....	Nov 58	1959	Do.
Fargo, N. Dak.....	May 59	1961	Do.
Hopkinton-Everett, N.H.....	Apr 59	1963	Reservoir.
Kettle Creek, Pa.....	May 59	1961	Do.
Lavaca-Navidad Rivers at Hallettsville, Tex.	Apr 59	1960	Channel improvement.
Marmarth, N. Dak.....	May 59	1959	Local protection.
Middle Creek, Calif.....	Jul 58	1960	Do.
Multnomah County Drainage District No. 1, Oreg.	Jun 59	1960	Do.
Nolin, Ky.....	Jan 59	1962	Reservoir.
Ottawa, Kans.....	Aug 58	1962	Local protection.
Pendleton, Oreg.....	Jan 59	1959	Do.
Pomono, Kans.....	Jun 59	1963	Reservoir.
St. Louis, Mo.....	Mar 59	1969	Local protection.
Salt Lake City, Utah.....	Apr 59	1960	Do.
San Lorenzo Creek, Calif.....	Mar 59	1961	Do.
Santa Clara River, Calif.....	Jun 59	1960	Do.
Santa Maria Valley, Calif.....	do	1961	Do.
Walnut Bayou, Ark.....	Jul 58	1960	Do.
West Hill, Mass.....	Jun 59	1961	Reservoir.
Whitlow Ranch, Ariz.....	May 59	1960	Do.

The 71 flood control projects under active construction during the fiscal year, exclusive of multiple-purpose projects and those projects placed in useful operation or initiated during the year as given in tables 5 and 6, are listed in table 7.

Table 7. Flood-Control Projects Under Active Construction During Fiscal Year 1959

Project	Date started	Scheduled completion date	Nature of project
Abilene, Kans.....	1958	1960.....	Local protection.
Abiqui (Chamita Reservoir Project), N. Mex.	1956	1962.....	Reservoir.
Amazon Creek, Oreg.....	1951	1959.....	Local protection.
Amite River and tributaries, La.....	1957	1961.....	Do.
Anacostia River Basin, D.C. and Md.....	1955	1959.....	Do.
Ball Mountain, Vt.....	1956	1960.....	Reservoir.
Battle Creek, Kalamazoo River, Mich.	1957	1962.....	Local protection.
Bear Creek, Pa.....	1956	1960.....	Reservoir.
Beardstown, Ill.....	1954	1962.....	Local protection.
Bradford, Pa.....	1955	1961.....	Do.
Buckhorn, Ky.....	1956	1960.....	Reservoir.
Buffalo Bayou (Brays Bayou), Tex.....	1956	1963.....	Local protection.
Canyon, Tex.....	1958	1964.....	Reservoir.
Cape Girardeau, Mo.....	1956	1963.....	Local protection.
Carlyle, Ill.....	1958	1966.....	Reservoir.
Central and Southern Florida.....	1950	After 1966.....	Local protection.
Clear Creek Drainage and Levee District, Illinois.	1940	1962.....	Do.
Columbia Drainage and Levee District No. 3, Illinois.	1938	1959.....	Do.
Cooper, Tex.....	1958	1964.....	Reservoir and channel.
Devil, East Twin, Warm, and Lytle Creeks, Calif.	1956	1961.....	Local protection.
Dillon, Ohio.....	1946	1961.....	Reservoir.
East Barre, Vt.....	1956	1959.....	Dam modification.
East Brimfield, Mass.....	1958	1960.....	Reservoir.
East St. Louis and vicinity, Ill.....	1937	1963.....	Local protection.
Endicott, Johnson City and Vestal, N.Y.	1957	1960.....	Do.
Howard A. Hanson, Wash. (Eagle Gorge).	1956	1962.....	Reservoir.
Jackson Hole, Snake River, Wyo.....	1957	Indefinite.....	Local protection.
Kansas City, Kans. and Mo.....	1940	1961.....	Do.
Keystone, Okla.....	1957	1965.....	Reservoir.
Little Sioux River and tributaries, Iowa.	1956	1961.....	Local protection.
Los Angeles County Drainage Area (exclusive of Whittier Narrows Reservoir), Calif.	1935	1966.....	Do.
Lower San Joaquin River, Calif.....	1956	1964.....	Do.
Lucky Peak, Idaho.....	1949	1960.....	Reservoir.
Mansfield, Ind.....	1956	1960.....	Do.

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Table 7. Flood-Control Projects Under Active Construction During Fiscal Year 1959—Continued

Project	Date started	Scheduled completion date	Nature of project
Memphis, Wolf River and Nonconnah Creek, Tenn.	1939	1961-----	Local protection.
Missouri River Agricultural Levees, Iowa, Kansas, Nebraska, and Missouri.	1948	Indefinite----	Do.
Missouri River, Kenslers Bend, Nebr., to Sioux City, Iowa.	1946	1961-----	Do.
Muscatine (Mad Creek), Iowa-----	1958	1959-----	Do.
North Adams, Mass-----	1950	1960-----	Do.
North Hartland, Vt-----	1958	1962-----	Reservoir.
North Springfield, Vt-----	1957	1960-----	Do.
Oklahoma City Floodway, Okla-----	1953	1959-----	Local protection.
Oologah, Okla-----	1950	1962-----	Reservoir.
Painted Rock, Ariz-----	1956	1960-----	Do.
Pasquotank River, N.C-----	1956	1959-----	Local protection.
Perry County Drainage and Levee District, Missouri.	1937	1963-----	Do.
Pomme de Terre, Mo-----	1957	1962-----	Reservoir.
Prairie du Rocher and vicinity, Ill----	1948	1959-----	Local protection.
Prompton, Pa-----	1958	1960-----	Reservoir.
Red River below Denison Dam, Tex----	1948	1963-----	Local protection.
Sacramento River flood control project, Calif.	1918	1964-----	Do.
Sacramento River major and minor tributaries, Calif.	1949	After 1966----	Do.
Salina, Kans-----	1958	1960-----	Do.
San Antonio and Chino Creeks Channel, Calif.	1956	1960-----	Do.
San Antonio Channel Improvement, Texas.	1957	After 1966----	Do.
Sioux Falls, S. Dak-----	1956	1960-----	Do.
Stillwater, Pa-----	1957	1960-----	Reservoir.
Success, Calif-----	1956	1961-----	Do.
Sutton, W. Va-----	1950	1959-----	Do.
Terminus, Calif-----	1957	1962-----	Do.
Thomaston, Conn-----	1958	1961-----	Do.
Topeka, Kansas River, Kans-----	1937	1963-----	Local protection.
Townshend, Vt-----	1957	1961-----	Reservoir.
Tuttle Creek, Kans-----	1952	1961-----	Do.
Vincennes, Ind-----	1952	Indefinite----	Local protection.
Waco, Tex-----	1958	1964-----	Reservoir.
Willamette River Basin (Bank Protection), Oregon.	1938	1966-----	Local protection.
Wilson, Wenkel, and Prairie du Pont Drainage and Levee District, Illinois.	1939	1961-----	Do.

Table 7. *Flood-Control Projects Under Active Construction During Fiscal Year 1959—Continued*

Project	Date started	Scheduled completion date	Nature of project
Wood River Drainage and Levee District, Illinois.	1947	1962-----	Local protection.
Woonsocket Local Protection, Rhode Island.	1956	1959-----	Do.
Worcester Diversion, Massachusetts--	1957	1960-----	Do.

Construction operations were also carried out pursuant to the small project authority contained in section 205 of the 1948 Flood Control Act as amended by Public Law 685, 84th Congress. Ten small projects were placed in useful operation pursuant to this program and 11 new projects were initiated during the fiscal year. In addition, design studies were carried out on 60 projects, and plans and specifications were under preparation for 9 projects which are expected to be initiated in fiscal year 1960.

Maintenance. Maintenance and operation activities were conducted on 120 flood-control projects during the fiscal year at a cost of \$5,910,925.

4. MULTIPLE-PURPOSE (POWER) PROJECTS

The importance of multiple-purpose projects in relation to the overall activities of the Corps of Engineers continued to increase during the fiscal year as a result of the large construction program relating to these projects currently under way and the placing in operation of primary-purpose features at several projects. These projects have been designed to serve primarily in the interest of navigation or flood control and the production of hydroelectric power, although frequently other benefits, such as irrigation, pollution abatement, water supply, and recreation, are also realized.

The inclusion of power features in conjunction with other project features has often resulted in an enhancement of their economic value. Pertinent information on the power aspects of multiple-purpose projects is contained in section 5 of this chapter.

Construction. During the year, construction operations were carried out on 23 multiple-purpose projects.

Table 8. *Multiple-Purpose Projects Completed for Full Beneficial Use During Fiscal Year 1959*

Project	Date started	Date completed for beneficial use	Project primary purposes
<i>None</i>			

During the year, one new multiple-purpose project, Big Bend Reservoir, S. Dak., was started.

Of the 23 multiple-purpose projects under active construction during the fiscal year, 9 projects had some or all primary project features in useful operation at the end of the year. These projects are listed in table 9.

Table 9. *Multiple-Purpose Projects Under Construction With Some or All Primary Project Features in Useful Operation June 30, 1959*

Project	Date started	Scheduled completion date	Features placed in operation during FY 1959	Project primary purpose
Cheatham Lock and Dam, Tenn.	Apr 50	Dec 60	2-12,000-kw units.	Navigation* and power.*
Old Hickory Lock and Dam, Tenn.	Jan 52	Jun 60	-----	Do.
Chief Joseph Dam, Wash.	Sep 59	Dec 60	-----	Power.*
The Dalles Dam, Wash. and Oreg.	Feb 52	Nov 62	Main unit generators 5 through 8.	Navigation,* power,* and irrigation.*
McNary Lock and Dam, Wash. and Oreg.	1947	Jun 60	-----	Navigation* and power.*
Table Rock Reservoir, Mo.	Oct 52	Jun 61	Flood control and power.	Flood control and power.
Bull Shoals Reservoir, Ark.	Apr 46	Apr 62	-----	Flood control* and power.*
Gavins Point Reservoir, S. Dak. and Nebr.	1952	Jun 60	-----	Do.
Garrison Reservoir, N. Dak.	Apr 46	Sep 61	-----	Do.

*Projects operated for these primary purposes at the beginning of and throughout fiscal year 1959.

Of the multiple-purpose projects under active construction at the end of the fiscal year, 14 projects had no primary-project features in operation. They are shown in table 10.

Table 10. Multiple-Purpose Projects Under Construction and Not Operating June 30, 1959

Project	Date started	Scheduled completion date	Project primary purposes
Barkley Dam, Ky-----	Jun 57	Apr 65	Flood control, navigation, and power.
Cougar Reservoir, Oreg-----	Jun 56	FY 63	Flood control, navigation, power, and irrigation.
Hills Creek Reservoir, Oreg-----	May 56	FY 62	Do.
John Day Lock and Dam, Oreg. and Wash.	Jun 58	Feb 69	Do.
Ice Harbor Lock and Dam, Oreg., Wash., and Idaho.	Dec 55	Jun 62	Navigation and power.
McGee Bend Reservoir, Tex-----	Sep 56	Jun 63	Power.
Greers Ferry Reservoir, Ark-----	Jun 57	Jun 64	Flood control and power.
Dardanelle Lock and Dam, Ark-----do-----	do	Jun 70	Navigation and power.
Eufaula Reservoir, Okla-----	Dec 56	1965	Flood control and power.
Hartwell Reservoir, Ga. and S.C---	Oct 55	Jun 63	Flood control, navigation, and power.
Walter F. George Lock and Dam, Ga. and Ala.	Sep 55	do	Navigation and power.
Oahe Reservoir, S. Dak. and N. Dak.	1949	1965	Flood control, navigation, power, and irrigation.
Fort Peck, Mont., second power-plant.	Aug 56	May 62	Power.
Big Bend Reservoir, S. Dak-----	Jun 59	Jun 67	Flood control, navigation, conservation, and power.

Maintenance. Operation and maintenance activities were conducted on 32 multiple-purpose projects during the fiscal year at a cost of \$17,361,233.

5. HYDROELECTRIC POWER PRODUCTION

The civil works program for the construction and operation of hydroelectric power facilities as part of the Corps of Engineers' multiple-purpose projects continues to progress. Production of electric energy was 1.85 percent less than the preceding fiscal year due principally to a decrease in industrial power requirements in the Northwest area and below-normal streamflow conditions in the Southwestern and Southeastern areas.

Under existing laws, the Corps of Engineers delivers, with one minor exception, the power produced and available for sale to the Department of the Interior for disposition at rates approved by the Federal Power Commission.

Installed capacity. Generating capacity of 488,000 kilowatts (nameplate rating) was installed and placed in operation during the fiscal year. The additional capacity consisted of six generating units installed in three existing projects and two units installed in one new project as shown in table 11. This additional capacity represents 18.7 percent of the hydroelectric capacity and 3 percent of the total generating capacity added to the Nation's utility systems during the fiscal year.

As of June 30, 1959, the Corps of Engineers had a total of 6,104,400 kilowatts of nameplate generating capacity in operation at 32 projects as listed in table 12. The 376,000 kilowatts installed in the Chief Joseph and The Dalles projects was a substantial addition to the generating capacity of the Northwest area. At the end of the fiscal year, the total generating capacity in operation at Corps of Engineers' multiple-purpose projects with power represents 4.18 percent of the total generating capacity and 20.6 percent of the hydroelectric generating capacity supplying the Nation's utility systems.

Hydroelectric power production. During the fiscal year the production of electric energy at Corps of Engineers' projects amounted to 26.7 billion net kilowatt-hours, or 0.5 billion less than during fiscal year 1958. A reduction in industrial load requirements, particularly in the Northwest area, and below-normal streamflows in the Southwest and Southeast are primarily responsible for the decrease in power production. Corps of Engineers power production for fiscal year 1959 represents approximately 3.9 percent of the total electric energy produced and 20 percent of the hydroelectric energy produced by the Nation's utility systems for this period. Chart I illustrates the trend of power production for Corps of Engineers multiple-purpose projects with power.

Additional capacity under construction. As of June 30, 1959, the Corps of Engineers had under construction 910,000 kilowatts of additional capacity at 6 operating projects and 3,690,400 kilowatts of capacity at 14 new projects for a total of 4,600,400 kilowatts of capacity under construction as listed in tables 12 and 13.

Projects in operation and under construction have a total ultimate capacity of 14,025,400 kilowatts, of which, under construction schedules at the beginning of fiscal year 1960, 6,508,400 kilowatts of capacity will be in operation by June 30, 1960. Chart II shows the rapid increase of installed capacity at Corps of Engineers projects in recent years.

Table 11. Generating Capacity Placed in Service During Fiscal Year 1959

Project	Size of units (kilowatts)	Number of units	Added capacity (kilowatts)
Cheatham, Tenn.....	12, 000	1	12, 000
Chief Joseph, Wash.....	64, 000	1	64, 000
Table Rock, Ark. and Mo.*.....	50, 000	2	100, 000
The Dalles, Oreg. and Wash.....	78, 000	4	312, 000
Total.....		8	488, 000

*Project began initial operation during fiscal year.

HYDROELECTRIC POWER PRODUCTION NET ANNUAL KILOWATT-HOURS

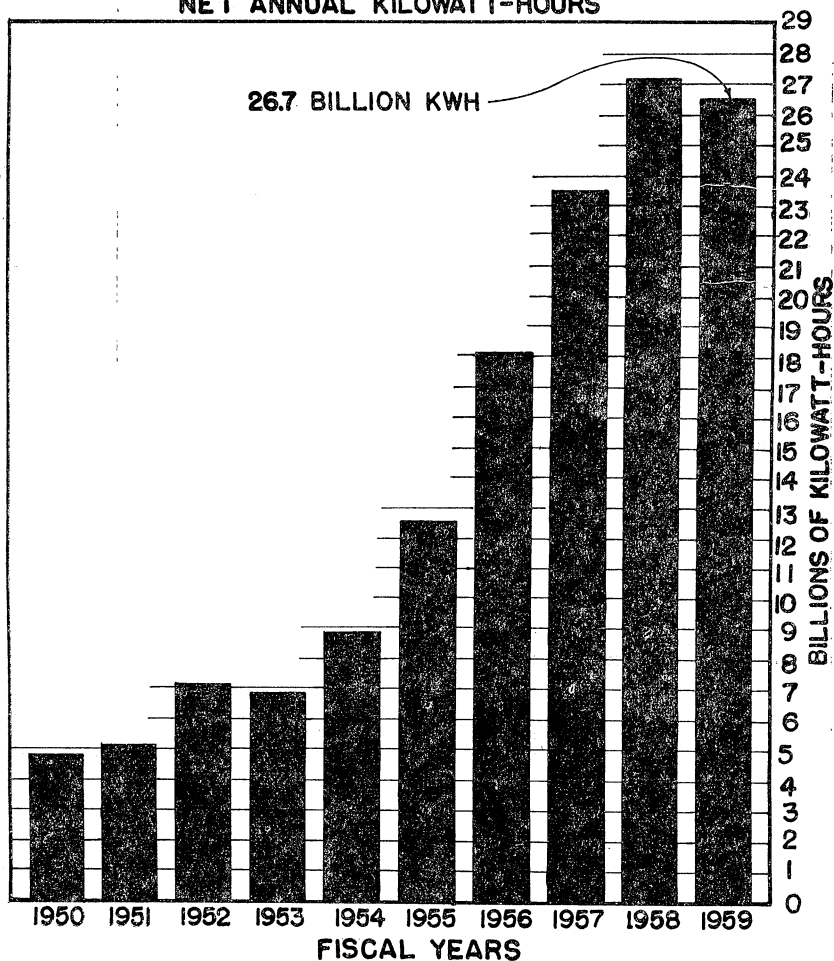


Chart I

HYDRO-POWER PRODUCTION CAPACITY
OPERATING AND SCHEDULED

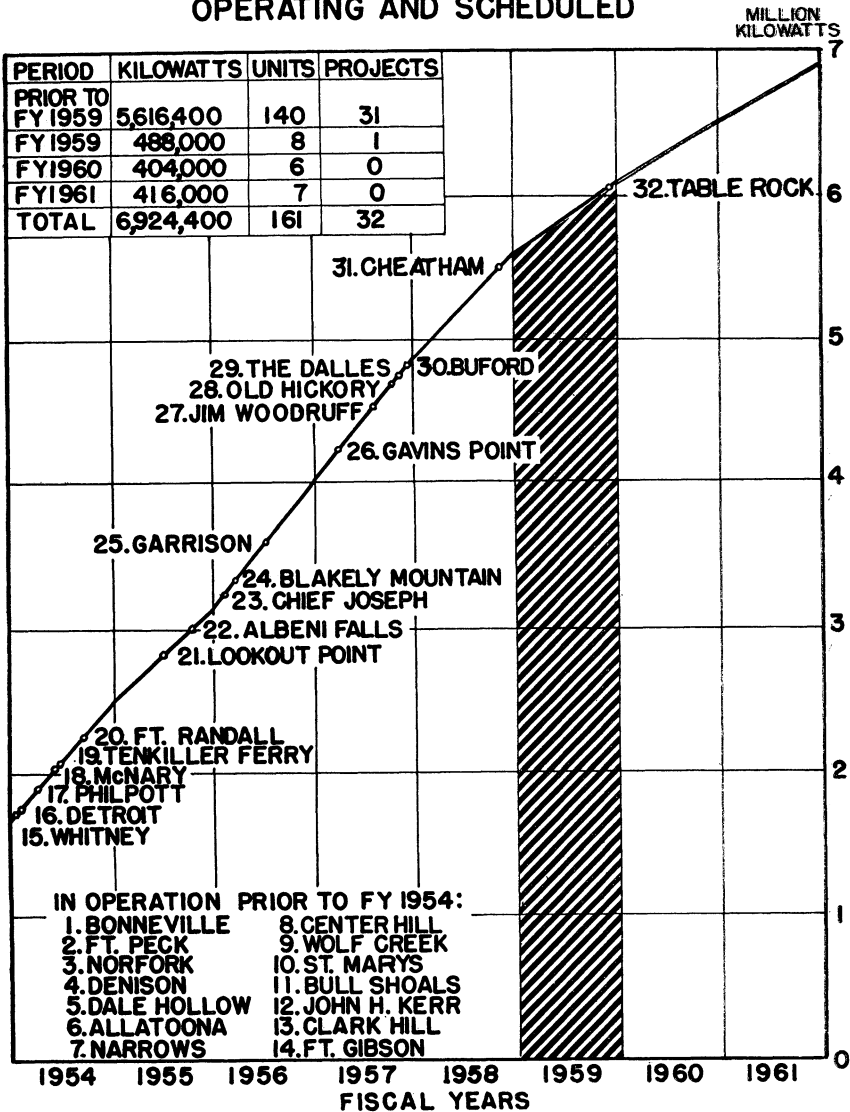


Chart II

Table 12. *Hydroelectric Projects in Operation June 30, 1959*

Project	Initial operation, fiscal year	Existing installation (kilowatts)	Under construction (kilowatts)	Ultimate construction (kilowatts)
Albeni Falls, Idaho-----	1955	42, 600	-----	42, 600
Allatoona, Ga-----	1950	74, 000	-----	110, 000
Blakely Mountain, Ark-----	1956	75, 000	-----	75, 000
Bonneville, Oreg. and Wash-----	1938	518, 400	-----	518, 400
Buford, Ga-----	1957	86, 000	-----	86, 000
Bull Shoals, Ark. and Mo-----	1953	160, 000	90, 000	340, 000
Center Hill, Tenn-----	1951	135, 000	-----	135, 000
Cheatham, Tenn-----	1958	24, 000	12, 000	36, 000
Chief Joseph, Wash-----	1956	1, 024, 000	-----	1, 728, 000
Clark Hill, Ga. and S.C-----	1953	280, 000	-----	280, 000
Dale Hollow, Tenn-----	1949	54, 000	-----	54, 000
Denison, Okla. and Tex-----	1945	70, 000	-----	175, 000
Detroit, Oreg-----	1954	118, 000	-----	118, 000
Fort Gibson, Okla-----	1953	45, 000	-----	67, 500
Fort Peck, Mont-----	1944	85, 000	80, 000	165, 000
Fort Randall, S. Dak-----	1954	320, 000	-----	320, 000
Garrison, N. Dak-----	1956	240, 000	160, 000	400, 000
Gavins Point, Nebr. and S. Dak-----	1957	100, 000	-----	100, 000
Jim Woodruff, Fla. and Ga-----	1957	30, 000	-----	30, 000
John H. Kerr, N.C. and Va-----	1953	204, 000	-----	204, 000
Lookout Point, Oreg-----	1955	135, 000	-----	135, 000
McNary, Oreg. and Wash-----	1954	980, 000	-----	1, 400, 000
Narrows, Ark-----	1950	17, 000	-----	25, 500
Norfork, Ark. and Mo-----	1944	70, 000	-----	140, 000
Old Hickory, Tenn-----	1957	100, 000	-----	100, 000
Philpott, Va-----	1954	14, 000	-----	14, 000
St. Marys, Mich-----	1952	18, 400	-----	18, 400
Table Rock, Ark. and Mo-----	1959	100, 000	100, 000	200, 000
Tenkiller Ferry, Okla-----	1954	34, 000	-----	34, 000
The Dalles, Oreg. and Wash-----	1957	651, 000	468, 000	1, 743, 000
Whitney, Tex-----	1954	30, 000	-----	30, 000
Wolf Creek, Ky-----	1952	270, 000	-----	270, 000
Total, projects in operation-----		6, 104, 400	910, 000	9, 094, 400

Table 13. Hydroelectric Projects under Construction June 30, 1959

Project	Scheduled operation, fiscal year	Nameplate capacity		
		Existing installation (kilowatts)	Under construction (kilowatts)	Ultimate installation (kilowatts)
Barkley, Ky. and Tenn.....	1965	-----	130, 000	130, 000
Beaver, Ark.....	1965	-----	112, 000	112, 000
Big Bend, S. Dak.....	1965	-----	468, 000	468, 000
Cougar, Oreg.....	1963	-----	25, 000	60, 000
Dardanelle, Ark.....	1965	-----	124, 000	124, 000
Eufaula, Okla.....	1965	-----	90, 000	90, 000
Greers Ferry, Ark.....	1964	-----	96, 000	96, 000
Hartwell, Ga. and S.C.....	1962	-----	264, 000	330, 000
Hills Creek, Oreg.....	1962	-----	30, 000	30, 000
Ice Harbor, Wash.....	1962	-----	270, 000	540, 000
John Day, Oreg. and Wash.....	1967	-----	1, 304, 400	2, 174, 000
McGee Bend, Tex.....	1965	-----	52, 000	52, 000
Oahe, N. Dak. and S. Dak.....	1963	-----	595, 000	595, 000
Walter F. George, Ala. and Fla.....	1963	-----	130, 000	130, 000
Total projects under construction.....		-----	3, 690, 400	4, 931, 000
Total projects in operation (table 12).....		6, 104, 400	910, 000	9, 094, 400
Total.....		6, 104, 400	4, 600, 400	14, 025, 400
Total, projects in operation and under construction.....		10, 704, 800		

6. MISSISSIPPI RIVER FLOOD CONTROL

The project for Mississippi River and tributaries project, authorized by the Flood Control Act of May 15, 1928, and subsequent amendments, provides for flood protection of its alluvial valley below Cape Girardeau, Mo., from Mississippi River and local floods by means of levees and floodwalls, channel realinement and stabilization, reservoirs, floodways, outlets, and drainage works. Authorizations through 1953 are described on pages 10 and 11 of part I, volume I, of the Annual Report of the Chief of Engineers for 1953. Amendments to the project in the Flood Control Act, approved September 3, 1954, are described in the report of 1955. Amendments to this project in the Flood Control Act, approved July 3, 1958, authorized the construction of the following additional improvements:

Work authorized	Authorized additional cost in dollars	Document
Boeuf and Tensas Rivers and Bayou Macon, Ark.*	1, 212, 000	S. Doc. 108, 85th Cong., 1st sess.
Greenville Harbor, Miss.-----	1, 799, 500	S. Doc. 15, 86th Cong., 1st sess.
Modification of the White River Backwater Project Pumping Plant.	2, 380, 000	S. Doc. 26, 85th Cong., 1st sess.
Wolf River and tributaries, Tenn., flood protection.	1, 932, 000	H. Doc. 76, 85th Cong., 1st sess.
St. Francis Basin, Ark. and Mo.*-----	35, 674, 000	
Old River, La.*-----	28, 200, 000	
Total-----	71, 197, 500	

*Increase in authorized cost of authorized work.

The total authorization for the project at the end of the fiscal year is \$1,398,877,100, of which \$1,056,243,700 has been appropriated and \$1,048,996,400 has been expended.

Construction. During the year, items of construction in four projects have been completed as shown in table 14.

Table 14. Projects Which Have Been Fully Completed During the Year

Project	Date completed	Nature of project work
Old River, La.-----	Jun 59	Low sill structure.
Tensas Basin, Ark.-----	Aug 58	Canal 19, Ark., channel improvement, Reaches 1 and 2.
	Apr 59	Canal 19, Ark., removal of plug and construction of 2 dams.
Yazoo Basin, Miss.-----	Feb 59	Lower auxiliary channel, leveed floodway and landside drainage ditches—mile 7.0–17.2.
	Oct 58	Lower auxiliary channel, leveed floodway and landside drainage ditches—lower 7 miles.
Big Sunflower River, etc., Miss.	Mar 59	Holly Bluff Cutoff, Big Sunflower River between mile 19.22 and mile 33.50.

During the year, features of three projects were placed in useful operation as shown in table 15.

Table 15. Projects Placed in Useful Operation

Project	Date placed in operation	Nature of project work
Atchafalaya Basin, La.-----	Jul 58	Franklin pumping station.
Big Sunflower River, etc., Miss.	Feb 59	Holly Bluff Cutoff, Big Sunflower River between mile 19.22 and mile 33.50.
Reelfoot Lake, Tenn. and Ky.	Jan 59	Running Reelfoot Bayou, channel improvement.

During the year progress was made in the continuing construction of the principal features of the project on the main stem and on the tributaries in the alluvial valley. Main stemwork on levees, revetment, dikes, and dredging was accomplished as follows: New mainline levees constructed, 6.7 miles; mainline levees enlarged to grade and section, 16.9 miles; secondary levees constructed, 31.8 miles; bank protection placed, 23 miles; dikes constructed, 4.8 miles; construction dredging, 8,807,000 cubic yards. At the end of the fiscal year, a total of 1,721 miles of mainline levees, containing 1,092 million cubic yards, had been constructed, of which 1,570 miles, containing 1,018 million cubic yards, are located along the Mississippi River, and the remainder along major tributaries (lower Arkansas and Red Rivers) and outlets. Work was continued on additional project features as shown in table 16.

During the year, work was initiated on the project features shown in table 17.

During the year, preconstruction planning was continued on Mississippi River levee enlargement and bank revetments, New Madrid, Mo., floodway closure, and on the alluvial valley levees and channel improvements under construction. Such planning was also initiated on the additional work shown in table 18.

Incident to the construction of the project, the features shown in table 19 were maintained and operated during the year.

Floods. No flooding of consequence occurred on the Mississippi River from Cairo, Ill., to its mouth during fiscal year 1959. The highest stages occurred in July and August 1958, and at Cairo, Ill., Arkansas City, Ark., Red River Landing, La., and New Orleans, La., were 0.2 feet, 12 feet, 6 feet, and 5.5 feet, respectively, below flood stage. Red River crested at Alexandria, La., on February 21, 1959, at a stage of 17.8 feet, approximately 14 feet below flood stage. Stages on the Ouachita River on July 1, 1958, at Monroe, La., and

Table 16. *Projects on Which Construction Was Continued During Fiscal Year 1959*

Project	Nature of project work
Mississippi River improvements	Levees, revetments, dredging, dikes, and wave wash protection.
Memphis Harbor (Tennessee Chute), Tenn.	Levee.
Vicksburg Harbor, Miss-----	Retaining dikes and approach fill.
Baton Rouge Harbor (Devils Swamp), La.	Barge channel and turning basin.
Lake Pontchartrain, La-----	Levee enlargement, shaping, and wave wash protection.
Atchafalaya Basin, La-----	Levees, channel improvement by dredging, and highway relocation.
Old River, La-----	Overbank control structure and outflow channel.
Tensas Basin, Ark-----	Canal 19, Ark., channel improvement, Reach 3.
	Canal 81, Ark., channel improvement, Reach 1.
Yazoo Basin, Miss-----	David and Burrell Bayous, channel improvement.
	Pompey Ditch levee setback.
	East bank new levee—Yazoo City to Techeva Creek.
Big Sunflower River, etc., Miss---	Little Sunflower River, channel improvement, mile 6.14 to mile 27.75.
Lower Arkansas River, Ark. (north bank).	Enlargement and construction of levees and drainage structures.
Lower White River, Ark-----	White River backwater levee system, levee enlargement.
St. Francis River, Ark. and Mo---	Floodways, cutoffs, channel enlargement, levees, interior drainage channels, highway and railroad crossings.

Jonesville, La., were 1 and 4 feet, respectively, below flood stage. A rise occurred in February and March 1959 which produced crest stages about 7 feet above flood stage at Arkadelphia and Camden, Ark., and about 8 feet and 10 feet below at Monroe and Jonesville, respectively. A rise in the Boeuf-Tensas Basin in Louisiana in September 1958 produced stages approaching bankfull in the lower portion of the basin. In the Yazoo Basin, Miss., the Tallahatchie River crested at Swan Lake, Miss., in September 1958 at a stage of 27.7 feet, about 1.5 feet above flood stage. The Yazoo River crested at Greenwood, Miss., in September 1958 at a stage of 32.5 feet, about 2.5 feet below bankfull. Operation of flood control reservoirs in the Yazoo Basin effected reductions in stage averaging 5 feet on the Coldwater River, 4 feet on the Tallahatchie River, and 1.5 feet on the Yazoo River at

Table 17. *Projects on Which Construction Was Initiated During Fiscal Year 1959*

Project	Date initiated	Nature of project work
Vicksburg Harbor, Miss----	Mar 59	Harbor channel, approach navigation channel, and industrial fill.
Old River, La-----	Jul 58	Initial excavation for navigation lock.
Big Sunflower River, etc., Miss.	Sep 58	Big Sunflower River, channel improvement, mile 33.50 to mile 34.75 and mile 77.50 to mile 99.00.
	Jul 58	Bogue Phalia, channel improvement, mile 8.5 to mile 20.9.
	Mar 59	Bogue Phalia, channel improvement, mile 30.0 to mile 47.0.
	Apr 59	Steele Bayou (Canal 9), channel improvement, Steele Bayou mile 55.06 to mile 65.97, and Canal 9 mile 0.00 to mile 22.20.
Yazoo Basin, Miss-----	Jul 58	Lower auxiliary channel, leveed floodway and landside drainage ditches—mile 17.2 to mile 20.7.
	May 59	Lower auxiliary channel, leveed floodway and landside drainage ditches—mile 20.7 to mile 24.9.
	Mar 59	West bank new levee—Yazoo City to Belle Prairie.
Tensas Basin, Ark-----	Aug 58	Canal 43, Ark., channel improvement, Reach 2.
	Feb 59	Canal 81, Ark., channel improvement, Reach 2.

Greenwood. The big Sunflower River crested in September and October 1958 at about bankfull stage.

The St. Francis River crested at St. Francis, Ark., on November 28, 1958, at a stage of 19 feet, about bankfull. Operation of flood control works on the St. Francis River effected stage reductions above Lake City, Ark., ranging from 1 to 4 feet. The lower White River crested about 2 feet above bankfull stage at Clarendon, Ark., on February 20 to 23, 1959, at a stage of 26.6 feet, which was materially reduced by operation of upstream reservoirs. Crest stages on the West Tennessee tributaries occurred as follows: Obion River at Bogota, Tenn., 20.5 feet on February 20, 1959; North Fork Forked Deer River at Dyersburg, Tenn., 24.2 feet on February 17; Hatchie River at Rialto, Tenn., 14.9 feet on February 17. These stages were 7.5 feet, 10.2 feet, and 2.9 feet, respectively, above flood stage. Wolf River crested at 14.3 feet at Raleigh, Tenn., on February 16, 1959. Loosahatchie River crested at 24.2 feet at Brunswick, Tenn., on February 15, 1959.

Table 18. Projects on Which Preconstruction Planning Was Initiated During Fiscal Year 1959

Project	Nature of project work
Yazoo Basin, Miss-----	Main stem Greenwood cutoff. McKinney Bayou, channel improvement. McKinney Bayou, pumping plant.

Table 19. Projects on Which Maintenance and Operation Activities Were Conducted During Fiscal Year 1959

Project	Nature of project work
Mississippi River-----	Channel maintenance dredging, levees, revetments, dikes, and wave wash protection.
Bonnet Carre Spillway, La-----	Levees, floodway, and control structure.
Atchafalaya Basin, La-----	Levees and channels. Operation and maintenance: Locks: Bayou Sorrel. Bayou Boeuf. Berwick. Floodgates: Charenton. Calumet. Bayou Courtableau. Drainage structures: Wax Lake outlet and numerous smaller drainage structures.
Atchafalaya and Old Rivers, Morgan City—Mississippi River, La.	Dredging navigation channel through Grand and Six Mile Lakes.
Morganza Floodway, La-----	Floodway and control structure.
Lower Red River, La-----	Levees and bank protection works.
Yazoo Basin, Miss.:	
Yazoo Basin Headwater-----	Levees and channels.
Greenwood, Miss-----	Local protection—levees, pumping stations, and drainage structures.
Yazoo City, Miss-----	Do.
Sardis Reservoir, Miss-----	Reservoir.
Arkabutla Reservoir, Miss----	Do.
Enid Reservoir, Miss-----	Do.
Grenada Reservoir, Miss-----	Do.
St. Francis Basin, Mo.: Wappa- pello Reservoir.	Do.

Condition of overall project. At the end of the fiscal year, construction on the project as a whole between Cape Girardeau, Mo., and the Gulf of Mexico was about 70 percent complete. Work on the main stem is sufficiently well advanced to afford excellent protection from Mississippi River flood overflow to most of the alluvial valley, except in the unprotected backwater areas. A total of 1,461 miles of mainline levees has been enlarged to project grade and section. The Mississippi River bank stabilization program has progressed steadily during recent years through construction of bank revetment, dikes, and corrective dredging, to prevent the river from regaining its former length due to its natural tendency to meander. A long-range plan is being developed to bring about and maintain the desired alinement of the river between Baton Rouge, La., and Cairo, Ill.

At the end of the fiscal year, there were 410 miles of operative revetment and 65,480 linear feet of effective dikes on the Mississippi River below Cairo, Ill. Additional project work on the lower Arkansas River consisted of 18.5 miles of revetment and 68,200 linear feet of dikes. Additional project work on lower Red River and the Atchafalaya River consisted of 6 miles of revetment and 16,017 linear feet of dikes. The Arkabutla, Sardis, Enid, and Grenada Reservoirs in the Yazoo Basin, Miss., and the Wappappello Reservoir in the St. Francis Basin, Mo., have been completed. Other authorized improvements in the alluvial valley, including levees, channel improvements, and supplementary drainage works, are under construction. A total of 1,183 miles of secondary levees, containing 371 million cubic yards, is in place. The Bonnet Carre, Morganza, West Atchafalaya, and Atchafalaya Floodways in Louisiana, which are in a useful operational status, will permit the diversion of 1,750,000 cubic feet per second of extreme flood discharge to the Gulf of Mexico, leaving 1,250,000 cubic feet per second to pass down the main stem at New Orleans, La. On completion, the Old River control structure will prevent the steadily enlarging channels of the Old and Atchafalaya Rivers from capturing the flow of the Mississippi River. The total damages that have been prevented since the adoption of the project are estimated at about \$6 billion, which amounts to approximately \$6 in benefits for every dollar of project funds so far appropriated.

The authorized Mississippi River and tributaries project, as amended, provides for a 12- by 300-foot navigation channel on the Mississippi River between Baton Rouge, La., and Cairo, Ill., and a 12- by 125-foot navigation channel on the Old and Atchafalaya Rivers between the Mississippi River and Morgan City, La. The Mississippi River channel between Baton Rouge and Cairo was main-

tained to provide a dependable 9-foot depth for navigation, except for one day during the year, with commensurably greater depths available during the high water season. On one day, September 8, 1958, the controlling depth at mile 686 AHP was 8.5 feet. The Atchafalaya River channel through Grand and Six Mile Lakes, between the Mississippi River and Morgan City, was maintained to provide project depth throughout the year.

Comprehensive review of Mississippi River and tributaries project. The comprehensive project review, authorized on June 12, 1954, covers the need for navigation improvements on the main stem, the adequacy and cost of flood control features of the project, and the coordination of these features with the plans of other Federal and State agencies for the development, conservation, and utilization of water resources in the alluvial valley. During the year, work was continued on this review which consists of field investigations and office studies of authorized alluvial valley project features, as well as modifications thereof, and flood control, drainage, and water supply improvements that have been requested by local interests at public hearings. In response to the request of the president of the Mississippi River Commission, the State soil conservationists of Missouri, Arkansas, Kentucky, Louisiana, Tennessee, and Mississippi, with the assistance of other agencies of the Soil Conservation Service, the Forest Service, and the Agricultural Research Service of the U.S. Department of Agriculture, furnished agricultural economic data for use in determining the economic justification of proposed improvements. The Fish and Wildlife Service of the U.S. Department of the Interior, with the assistance of State game and fish commissions, made investigations to determine desirable plans for the coordination of proposed improvements with the conservation of fish and wildlife habitat. A supplementary study was continued to determine the benefits from upstream reservoirs in the relief of flood damage to lands and the increase of low streamflow in the Mississippi River below the Missouri River.

7. GENERAL OPERATIONS

Work done by contract. The Corps of Engineers for many years has consistently adhered to its policy of having construction work done by contractors wherever practicable. This past year was no exception to the policy. In fact, 96 percent of all construction work was performed by contract and only 4 percent by Government plant and hired labor. In recent years the amount of construction by hired labor has remained at this low percentage. A larger percentage of the maintenance work has been performed by hired labor. The hired labor work on construction projects has been limited to such types

of operations as dredging in exposed harbor entrances by Government-owned hopper dredge, the construction of erosion-control and levee-revetment works and grouting operations. The nature of such work does not readily lend itself to advertising and performance by contract.

Accident prevention. Injury rates continued at a low level. Chart III shows comparison of injury rates for Corps of Engineers' contractor employees with those for the construction industry. Also compared are injury rates for Corps of Engineers' employees with those for all employees of the Federal Government.

Fire prevention. Government property and equipment losses by fire during the year were \$31,795. Included in this total was a \$17,500 loss when fire on private property became uncontrolled and spread to the Government structure.

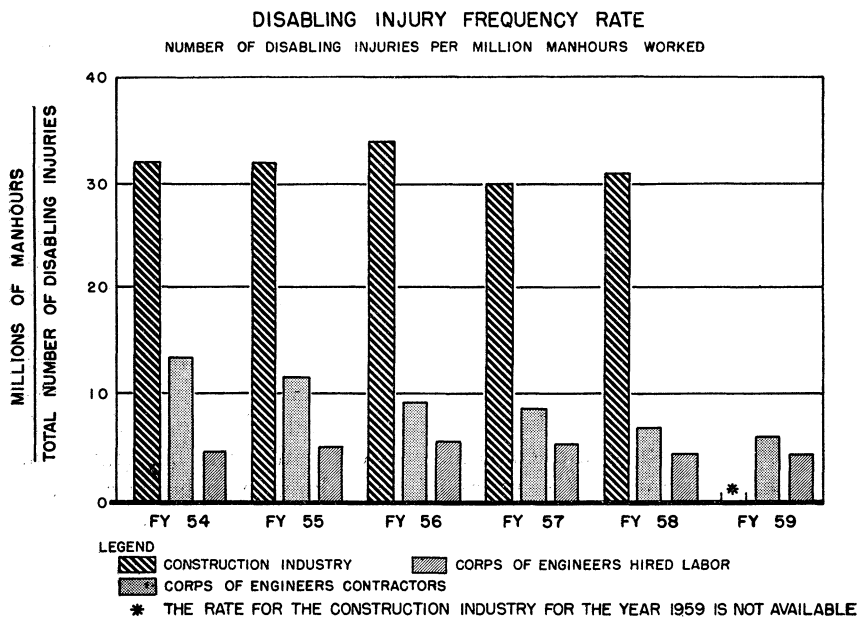


Chart III

CHAPTER III

BENEFITS OF THE PROGRAM

Since 1824 the Corps of Engineers has built and maintained the Nation's harbors and navigable waterways, and since 1936, when the Federal Government assumed responsibility for nationwide flood control, the Corps has been assigned responsibility for carrying out that task. The active program, including the \$1.5 billion Mississippi River and tributaries project, consists of 3,342 projects authorized by law having an estimated cost of \$18.4 billion. Some 2,460 projects costing \$3.5 billion have been completed, and an additional \$5.1 billion has been invested in projects under construction. Uncompleted portions of work under way, and authorized projects not started, aggregate about \$9.8 billion. The water resources projects now in operation have yielded important benefits, such as waterborne transportation, reduction of flood damages, electric energy, water supply, irrigation, low flow regulation, pollution abatement, recreational development, preservation and enhancement of fish and wildlife, and related water resources activities.

1. NAVIGATION

The navigation element consists of three major parts: coastal, Great Lakes, and inland. In 1958 deep-draft traffic in coastal harbors and channels in the United States and possessions amounted to 506 million tons of foreign and domestic commerce. There moved on the Great Lakes 132 million tons and on the inland waterways 367 million tons. These three elements aggregate 1,005 million tons. Great Lakes facilities moved over 80 billion ton-miles of traffic, and the inland system about 110 billion ton-miles. Each of these three systems has yielded vast savings in transportation costs, having more than justified all their construction and operating costs. (An analysis of that program, based on 1953 costs and waterborne commerce, is contained in vol. 1 of the 1955 Annual Report.) Total waterborne commerce of the United States in calendar year 1958 was 1 billion tons.

Coastal harbors and channels. These improvements have been progressive, keeping pace with the growth and requirements of maritime commerce. Natural channels have been improved to the greater depths required for ocean carriers of today. Depths of 35 feet now

generally prevail at major harbors on the Atlantic and Gulf coasts, ranging up to 45 feet in New York Harbor. Depths of 30 to 40 feet are generally available along the Pacific coast. Harbors and channels of lesser depths have been provided for commercial fishing, recreational boating, and harbors of refuge.

Great Lakes. This is one of the world's largest and busiest fresh water systems. Eight States border on the lakes, and nine others are directly tributary thereto. The lakes have a total water surface of about 95,000 square miles, two-thirds of which is in the United States. These vast water areas, joined by the connecting channels, provide a low-cost transport artery that permits movement of bulk materials and products of every description in huge quantities to advantageously located manufacturing areas. Controlling depths in the connecting channels are generally 21 feet in upbound, and 25 feet in downbound channels; however, improvements to provide at least 27 feet are under way and scheduled to be usable in calendar year 1962.

This important transportation artery is connected with the Gulf of Mexico by means of 9-foot barge navigation on the improved Illinois Waterway and Mississippi River, and with the Atlantic Ocean by means of the New York State barge canal system and the Hudson River, and by the 27-foot St. Lawrence Seaway, placed in operation in 1959. Traffic on the Great Lakes in 1958 was about 80 billion ton-miles.

There are 57 federally improved harbors on the Great Lakes with project depths of 18 feet or more, of which 15 provide depths of 25 feet or more, and others to lesser depths. Many of the harbors will require improvement to handle the deeper draft traffic that will utilize the improved connecting channels and the St. Lawrence Seaway. Studies are currently under way to determine where improvement is advisable.

Inland and intracoastal waterways. This third element of the navigation program is an important part of the national transportation structure. These waterways have proved their worth, in peace and war, as routes for low-cost movement of bulk commodities to supplement the major forms of overland transport.

The Federal Government has improved in varying degree waterways in this country whose total length is some 22,230 miles, exclusive of the Great Lakes, to provide the most extensive inland navigation system in the world. Traffic on the inland waterway system in 1958 was about 110 billion ton-miles as compared with 42 billion ton-miles in 1949.

The large increase in traffic on the inland waterways in the past decade results in part from the fact that industry, recognizing the

economic advantages of low-cost water transportation and the availability of adequate water supplies for industrial processing, is crowding to and along the riverbanks.

2. FLOOD CONTROL

Federal interest in flood control began in the alluvial valley of the Mississippi when the Corps of Engineers first undertook navigation improvements on that river early in the 19th century, and when the interrelationship of flood control and navigation became apparent. This Federal interest took definite form with establishment of the Mississippi River Commission in 1879, but the first major Federal participation in flood control began in 1928 when Congress adopted the present project for flood control and navigation in the alluvial valley of the Mississippi. The responsibility for nationwide flood control was assigned to the Corps of Engineers by the 1936 Flood Control Act, which also established the Federal policy for that activity.

During the intervening period since 1936, the Corps of Engineers has completed 365 projects having a total cost of \$962 million; 173 projects having a total estimated cost of \$4.2 billion are under construction; and the remainder of the active program, consisting of 277 projects estimated to cost \$2.1 billion, has not been started. In addition, multiple-purpose reservoir projects complete or in partial operation have been providing important flood control benefits.

Corps of Engineers' projects complete or in partial operation for flood control have been highly effective in alleviating flood damages throughout the Nation. During the limited period they have been in operation they have prevented flood damages of almost \$9.2 billion, including almost \$200 million during fiscal year 1959. A breakdown of the damages prevented, according to major drainage basins or regions, follows:

	Fiscal year 1959	Cumula- tive to date
	<i>(In millions of dollars)</i>	
Alaska.....	0. 2	2
Arkansas-White-Red.....	4. 0	188
Central and South Pacific.....	1. 5	169
Central Valley.....	Minor	549
Colorado.....	Minor	Minor
Columbia.....	7. 2	196
Great Basin.....	Minor	Minor
Great Lakes-St. Lawrence.....	2. 5	11
Gulf and South Atlantic.....	16. 5	57
Hawaii.....	Minor	Minor
Lower Mississippi.....	15. 7	6, 018
Middle Atlantic.....	6. 5	158
Missouri.....	14. 6	777
New England.....	0. 9	108
North Pacific.....	0. 2	4
Ohio.....	122. 7	653
Rio Grande and Gulf.....	1. 3	153
Souris-Red.....	Minor	7
Upper Mississippi.....	0. 6	105
Total.....	194. 4	9, 155

Despite the progress made on the flood control program, adequate protection is not available in most areas, and the Nation is highly vulnerable to severe damages from major floods. Floods near the divide between the Missouri and the upper Mississippi River Basin of Iowa in July 1958 claimed 19 lives. Later in July and in August 1958, floods caused the loss of 11 lives in the Ohio River Basin in West Virginia and Pennsylvania. In the Ohio River Basin from Illinois northeastward to New York during January and February 1959, estimates indicate that about \$100 million in flood damages was experienced and about \$120 million in damages prevented. Major flooding also occurred in the Wabash Basin, the lower portion of the Missouri Basin, the lower Mississippi, and the Gulf and South Atlantic region.

The Nation will remain vulnerable to severe flood damage from major floods until an adequate degree of protection is achieved. This goal may be reached through orderly prosecution of existing flood control plans, expanded to meet economic development taking place in the flood plains. The results from completed flood control projects prove that much of the flood damage now experienced can be economically prevented.

3. OTHER BENEFITS

Large benefits in addition to navigation and flood control accrue through conservation and use of our water resources. These include hydroelectric power; water for industrial, municipal, and agricultural use; and numerous benefits that result from low-flow regulation. In many cases projects also provide public recreational values and enhance fish and wildlife resources.

Hydroelectric power. The position of hydroelectric power development in the civil works program has grown with the increasing needs of the Nation for electric energy, with the greater knowledge accumulated in recent years of the ability of rivers to supply that power, and as a result of the expanding Federal interest in its regulation, development, and use.

The civil works program, involving the construction of dams and reservoirs, has afforded large possibilities for the development of water power. Hydroelectric power production at Corps' projects in operation during fiscal year 1959 amounted to 27 billion net kilowatt-hours of electric energy. This represents approximately 20 percent of the hydroelectric power produced and about 4 percent of the total electric production from all sources of the Nation's utility systems. Details of hydroelectric power production at Corps of Engineers' projects are contained in chapter II, section 5.

Water supply and low-flow regulation. Droughts in various parts of the United States during recent years, growth of population, and increased demands of manufacturing processes have served to focus the attention of the general public and public officials on the need for adequate amounts of water of a suitable quality. Adequate water supplies are required for the future welfare of many communities and the availability of additional supplies will greatly affect their future development and the possible development of new towns and industries. As a result, many States are studying legislation to safeguard water supplies in the best overall public interest.

The Corps of Engineers has legislative authority to provide storage for water supply, provided local interests pay the cost, and to make contracts for surplus water at civil works projects. In addition, water supply features have been included in projects under special legislation. The Water Supply Act of 1958 provided a broader authority for the provision of water supply storage for future needs.

Under various appropriate authorities, numerous communities have obtained water supplies. The Corps of Engineers is providing 1,483,541 acre-feet of water storage in 19 reservoirs for more than

40 cities. An additional 549,500 acre-feet of storage under agreement will be provided by projects under construction.

Water Supply Storage Provided by the Corps of Engineers

Project	Water supply storage (acre-feet)	Local agency
Baldhill, N. Dak.-----	*69, 500	Eastern North Dakota, Water Development Association.
Belton, Tex.-----	12, 000	Fort Hood, Tex.
Belton, Tex.-----	113, 700	Brazos River Authority, Texas.
Berlin Dam, Ohio-----	19, 400	Mahoning Valley Sanitary District.
Burr Oak, Ohio (Tom Jenkins).-----	9, 300	State of Ohio.
Canton Dam, Okla.-----	90, 000	Oklahoma City, Okla.
Clark Hill, Ga. and S.C.-----	210	McCormick, S.C.
Dam B, Tex.-----	94, 200	Lower Neches Valley Authority, Texas.
Ferrells Bridge, Tex.-----	251, 100	Northeast Texas Municipal Water District.
Grapevine, Tex.-----	85, 000	Dallas, Tex.
Grapevine, Tex.-----	50, 000	Park Cities, Tex.
Grapevine, Tex.-----	1, 250	Grapevine, Tex.
Heyburn, Okla.-----	1, 000	Kiefer, Okla.
Homme, N. Dak.-----	*3, 650	Grafton and Park River, N. Dak.
Hords Creek, Tex.-----	5, 780	Coleman, Tex.
Hulah, Tex.-----	15, 400	Bartlesville, Okla.
Lake Texoma, Okla. and Tex.-----	21, 300	Denison, Tex.
Lavon Dam, Tex.-----	100, 000	North Texas Municipal Water District.
Lewisville, Tex.-----	415, 000	Dallas, Tex.
Lewisville, Tex.-----	21, 000	Denton, Tex.
Mosquito Creek, Ohio.-----	11, 000	Warren, Ohio.
San Angelo, Tex.-----	80, 351	Upper Colorado River Authority.
Texarkana, Ark. and Tex.-----	*13, 400	Cities of Texarkana, Ark. and Tex.
Total-----	1, 483, 541	

* Seasonal for flood control and water supply.

During the year over 800,000 acre-feet of water was furnished from reservoirs exclusively for domestic and industrial water supply. Other conservation releases of almost 5 million acre-feet, together with almost 20 million acre-feet from hydropower generation, improved the quantity, quality, and appearance of downstream flows, which benefited water supplies, recreation, and fish and wildlife.

Corps of Engineers' survey reports may include water uses that are properly related to proposed navigation and flood control projects. In that connection the formulation of comprehensive water

resources plans may include irrigation among the uses incorporated into flood control or navigation projects. Irrigation storage space in Corps of Engineers' reservoirs falls into two categories, one in which storage space is allocated exclusively to irrigation use, and the other where, because of existing seasonal patterns of flood runoff, irrigation may share storage with flood control or other project functions. About 4 million acre-feet of storage space is being operated either exclusively or jointly for irrigation and other uses, as shown in the following tabulation. Releases of water for irrigation during the year amounted to nearly 1.9 million acre-feet.

Irrigation Storage—in Operation—Corps of Engineers' Reservoirs

[In thousands of acre-feet]

Project	Exclusive irrigation storage	Joint-use storage	Releases
Conchas, N. Mex.	279		99
Cottage Grove, Oreg.		30	(4)
Dam B, Neches River, Tex. ¹			
Detroit, Oreg.		300	(4)
Dorena, Oreg.		70	
Fern Ridge, Oreg.		95	(4)
Folsom, Calif.		512	(2)
Harlan County, Nebr.	150		20
Isabella, Calif.		535	504
John Martin, Colo.	384		223
Lookout Point, Oreg.		340	(4)
Lucky Peak, Idaho.		280	(3)
Pine Flat, Calif.		1, 000	1, 026
Total.	813	3, 162	1, 872

¹ Carried under "Water Supply Storage."

² Operated by the Bureau of Reclamation.

³ Operated in conjunction with reclamation reservoirs.

⁴ Releases generate power, augment low flows, and serve irrigation and other purposes.

4. PUBLIC RECREATION USE OF PROJECT AREAS

The water areas and the public lands surrounding civil works projects continue to provide public recreational opportunities to more and more people. Reservoir projects, particularly, are being used for a greater variety of activities, with water skiing and family camping growing faster and presenting problems of management. Watercraft increased to over 100,000 boats. Total attendance increased to 95 million in calendar year 1958, compared with 84 million during 1957.

Funds in the amount of approximately \$1 million were expended by the Corps of Engineers in providing basic facilities or in enlarging existing facilities at completed projects. Most of these expenditures were utilized in constructing better roads, parking areas, boat launching ramps, water wells, and toilets. Some additional picknicking and camping facilities were added.

In addition to the facilities provided by the Corps, many State, county, and local governmental agencies have installed initial facilities or continued their development of park areas licensed to them. Concessionaires of the Department of the Army or of the cooperating governmental agencies have enlarged their facilities, particularly those providing boat care or overnight accommodations.

Various quasi-public agencies have developed or are in the process of developing 245 organized camps for youth or family group use.

A number of States have enacted State boating acts to further the objectives of the Federal Boating Act of 1958. Through the enforcement of these acts, safer boating is anticipated.

5. FISH AND WILDLIFE

Over 6 million acres of lands and waters of the civil works projects of the Corps of Engineers are the habitat for fish and upland game, and the nesting, resting, and feeding areas for millions of ducks, geese, and other migratory waterfowl. A high percentage of these lands and waters are open to fishing and to many forms of hunting. Most of the State wildlife agencies cooperate with the Corps of Engineers in conducting research in fishery management and in a wide field of wildlife research on these lands and waters. Many of these same agencies have resident wildlife conservation officers at the principal reservoir projects and manage a substantial acreage of the projects' lands wholly or in part for wildlife.

The Corps of Engineers continues to explore and cooperate with Federal and State wildlife agencies in carrying out the provisions of the Wildlife Coordination Act of 1958. Additional "general plans" for fish and wildlife management, as provided by that act, have been agreed to by the State agency having jurisdiction over fish and wildlife and by the Secretary of the Army and the Secretary of the Interior. More reservoir lands have been made available to the U.S. Fish and Wildlife Service and to the several States for wildlife management.

Over 18 million pounds of sport fish caught were reported. This did not represent the total sport fish caught nor does it include the large amount of commercial fish taken from these waters.

CHAPTER IV

CURRENT PROJECT PLANNING AND DEVELOPMENT

1. PROGRAM POLICY MATTERS

The Corps of Engineers continued participation with other Federal agencies and with agencies of the various States in activities pertaining to the development of national water resource policies. In addition, various policies and procedures in use by the Corps of Engineers were reviewed, improved, and modified. The more important of these activities are discussed in the following paragraphs.

Interagency Committee on Water Resources. The Interagency Committee on Water Resources is composed of policy officials at the secretarial level of the Departments of Agriculture; Army; Commerce; Health, Education, and Welfare; Interior; and Labor; and the Federal Power Commission. The committee establishes means and procedures to promote coordination of the water and related land resources activities of the member agencies, undertakes resolution of interagency differences, suggests to the President changes in policy that would promote coordination and reduce differences, and reviews problems referred to it by field committees. Field committees have been set up for the Missouri, Columbia, Pacific Southwest and Arkansas-White-Red Basins, and the New England-New York area.

The committee performed its regular activities principally through its subcommittees on hydrology, sedimentation, and evaluation standards. In August 1958 the committee approved publication of a revised version of the 1950 report on "Proposed Practices for Economic Analysis of River Basin Projects." A revision of the 1951 edition of the manual on "Policies and Procedures for Distribution and Coordination of Reports by Agencies Represented in the Interagency Committee on Water Resources" was published in July 1958.

Watershed protection and flood prevention. During fiscal year 1959 an agreement was reached between the Corps of Engineers and the Soil Conservation Service under which (a) local protection works, such as levees, for reducing urban flood damages will normally be proved by the Corps of Engineers under the flood control acts, rather than by the Soil Conservation Service under the authorities of Public Law 566 (the Watershed Protection and Flood Prevention Act of 1954, as amended); (b) protection of urban areas by reservoirs may

be provided by either agency; (c) unified joint plans will be developed where desirable; and (d) the two agencies will use uniform standards and procedures to the extent possible. It was also agreed that efforts will be made to further improve coordination between the engineering programs of the two agencies. A task force to work out solutions to the problems involved has been established by agreement between the Assistant Secretary of Agriculture and the Assistant Secretary of the Army.

The Department of Agriculture has continued to participate in the cooperative studies in the Delaware, Potomac, and Cape Fear River Basins, all of which were initiated prior to fiscal year 1959. These studies are expected to lead to the development of comprehensive and coordinated basinwide plans.

During fiscal year 1959 the Corps of Engineers reviewed 41 Public Law 566 plans and submitted comments thereon to the Secretary of the Army as a basis for the views and recommendations which he submits to the Secretary of Agriculture, pursuant to the provisions of Public Law 566. This increases to 133 the total number of watershed work plans reviewed by the Corps of Engineers since initiation of the Public Law 566 program.

Recreation. The Corps of Engineers, in carrying out the civil works program, has created a major recreational resource in the United States. There has been a 19-fold increase in recreational use of reservoir projects—from 5 million visits in 1946 to 95 million in 1958. Public use facilities provided originally are now inadequate. Furthermore, studies indicate that annual attendance by 1965 is expected to exceed 150 million.

This situation has necessitated further consideration of the Corps' recreational policies and procedures. Section 4 of the Flood Control Act of 1944, as amended by the 1954 act, provides authority for recreational use. The law requires that water areas be open to the public without charge and that ready access be provided.

Basic planning policies for recreational development are as follows:

In providing and administering flood control and navigation works the Corps of Engineers recognizes recreation as a tangible, important function and will provide and maintain basic facilities necessary for preservation of the resource and for public access and use. Non-Federal interests will be encouraged to provide recreational facilities, subject only to conformance with established Federal requirements.

Review of Joint Policy, Land Acquisition, Reservoir Projects, Department of the Interior, Department of the Army. In May 1958, the Assistant Director of the Bureau of the Budget requested the Departments of the Interior and the Army to review their reservoir land

acquisition policy to determine whether any modification was necessary to preserve opportunities for public recreation. Discussions were held by representatives of the two departments, the Special Assistant to the President for Public Works Planning, and the Bureau of the Budget. A supplement to the policy on land acquisition was prepared for presentation to the President.

Fish and Wildlife Coordination Act. This act (Public Law 85-624), approved August 12, 1958, provides that protection and development of wildlife resources shall receive equal consideration and be coordinated with other features of water resource development programs. Under the act, recommendations of the Secretary of the Interior on wildlife aspects are made an integral part of reports submitted to Congress for authorization. Federal agencies are authorized to modify project structures and operations and to acquire lands to conserve wildlife. The cost thereof may be allocated for this purpose, together with a finding as to the part to be borne by local interests.

In the interest of evaluating benefits and costs of fish and wildlife features, the Secretary of the Army recommended in September 1958 to the Interagency Committee on Water Resources that it study the problem and report its recommendations.

By the close of the year, a draft of the policies and procedures (EM 1165-2-104) had been completed and furnished to the Department of the Interior.

Cost sharing for hurricane flood protection projects. The Flood Control Act approved July 3, 1958, adopted three hurricane flood protection projects for Narragansett Bay, R.I., New Bedford, Mass., and Texas City, Tex., with Federal participation limited to 70 percent of the costs. Guidelines for application to other hurricane, tidal, and lake flood protection studies to conform with the policy in cost sharing established in the 1958 act were issued in EM 1120-2-114.

Water Supply Act of 1958. This act (title III, Public Law 85-500), approved July 3, 1958, provided additional authority for the Corps of Engineers to include water supply storage in any reservoir project. One of the most important features is the additional authority to provide water supply storage in reservoir projects for anticipated future demand, provided local interests give reasonable assurances that they will contract to pay costs allocated to water supply.

Policy instructions concerning application of the legislation were issued in EM 1165-2-105. Assistance by the Public Health Service will contribute to sound planning and economies in administering the act. Accordingly, a memorandum of agreement was consummated in November 1958 whereby the Public Health Service will

furnish advice and assistance in cooperation with local interests on the need and value of water supply.

Aquatic plant control. Progress has been made on planning for the aquatic plant control project authorized by the River and Harbor Act of 1958 in the eight coastal States from North Carolina to Texas. This is a cooperative project with the States and the other Federal agencies concerned, including the U.S. Agricultural Research Service, U.S. Fish and Wildlife Service, and U.S. Public Health Service, in which the States pay 30 percent of the costs. Various local interests concerned with navigation, flood control, drainage, agriculture, fish and wildlife conservation, public health, and related purposes are participating in the planning.

Operations have been initiated in Louisiana to determine the feasibility of eradicating water hyacinth with known methods. Florida and North Carolina have enacted legislation authorizing participation in aquatic plant control.

Many new features have required new procedures for operational and research aspects. There has been established a technical committee composed of representatives from each Federal agency. Project areas will be expanded to authorized scope as State governments qualify under the requirements of law. Far-reaching benefits of major proportions will become apparent as control operations proceed.

Remedial works (relocations). Section III of the River and Harbor Act approved July 3, 1958 (Public Law 85-500), provides that a governmental structure or facility adversely affected by construction of a project may be altered or paid for with project funds.

Preliminary guidance to implement this legislation was furnished during the year to District and Division Engineers pending completion of policy instructions concerning interpretation and application of the law.

Agreement between the Departments of the Army and the Interior on the Central Valley, Calif. Such an agreement was requested in August 1958 by the Director, Bureau of the Budget. An agreement subsequently adopted by the Secretaries of the Army and the Interior establishes planning jurisdiction. The Corps has primary responsibility for flood control and navigation and the Bureau of Reclamation for irrigation. Each agency will give full consideration to other uses and maintain coordination with the State of California.

The agreement further provides that construction and operation of Central Valley projects will be the responsibility of the agency obtaining authorization. In general, the Corps will prescribe the method of operation for flood control and navigation and the Bureau for irrigation, power, and water supply where the Bureau is the marketing agent.

As to the marketing of services, the constructing agency is responsible for contracting for water, except that the Department of the Interior shall have this responsibility when the water is integrated into the Bureau's Central Valley project. The Secretary of the Interior is responsible for contracting for irrigation service and power. The constructing agency is responsible for cost allocations. Either department shall recommend integration in the Central Valley project when, after consultation, the Secretary of the Interior determines this to be desirable.

Interagency Committee on Cost Allocation and Accounting. This committee, comprising representatives of the Corps of Engineers, Department of the Interior, Federal Power Commission, and General Accounting Office, was formed to resolve cost allocation problems and develop uniform power accounting. Nine meetings of the committee were held during the year and progress was made toward the development of mutually satisfactory procedures. Allocations of cost were also adopted for the main stem Missouri River system. Action was taken toward allocation of costs for the Detroit, Lookout Point, and Albeni Falls projects in the Columbia Basin. Problems associated with allocation of costs for a number of other projects were resolved.

International Passamaquoddy Tidal Power Survey. In accordance with Public Law 401, 84th Congress, and the Boundary Waters Treaty of 1909, Canada and the United States in 1956 directed the International Joint Commission to investigate the feasibility of developing the tides of Passamaquoddy and Cobscook Bays in New Brunswick and Maine for power. An International Passamaquoddy Engineering Board was one of two boards established by the Commission to make the study. The Engineering Board appointed an Engineering Committee to conduct the necessary studies. The Division Engineer, New England Division, serves as chairman of the U.S. Section of the Engineering Committee, and has established a special survey group which has performed much of the work. Reports of the international boards are scheduled for submission in October 1959 to the International Joint Commission. Funds totaling \$3,300,000 were authorized by the two Governments to conduct a 3-year study.

2. OMNIBUS RIVER AND HARBOR AND FLOOD CONTROL BILL

ACT OF 1958

The President on July 3, 1958, signed S. 3910, 85th Congress, authorizing construction of 139 river and harbor, beach erosion control, and flood control projects in 46 States and Puerto Rico.

The estimated Federal cost of work authorized in the bill is \$1,556,230,500, of which \$1,356,230,500 is for the Corps of Engineers and \$200 million is for Missouri River Basin work by the Department of the Interior.

The grand total is broken down as follows:

Title I. Rivers and Harbors:

Navigation projects-----	\$190, 723, 000
Beach erosion control projects-----	11, 627, 700
Total title I-----	202, 350, 700

Title II. Flood Control:

New projects or project modifications-----	545, 579, 800
Increased basin authorizations-----	608, 300, 000
Department of the Interior-----	200, 000, 000

Total title II-----	1, 353, 879, 800
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Grand total-----	1, 556, 230, 500
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The act also authorized 61 surveys in 28 States.

PENDING RIVER AND HARBOR AND FLOOD CONTROL LEGISLATION

The House Public Works Committee held hearings on various projects previously submitted to Congress by the Secretary of the Army. An omnibus bill, H.R. 7634, 86th Congress, was subsequently (July 16, 1959) passed by the House of Representatives. The bill would authorize 48 river and harbor, beach erosion control, and flood control projects in 21 states. A summary of the authorizations contained in the bill as it passed the House is as follows:

Title I. Rivers and Harbors:

Navigation projects-----	\$86, 581, 500
Beach erosion control projects-----	371, 300
Monetary authorization (Barkley Dam, Ky.)-----	146, 000, 000

Total title I-----	232, 952, 800
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Title II. Flood Control:

New projects or project modifications-----	45, 357, 700
Increased basin authorizations-----	379, 000, 000

Total title II-----	424, 357, 700
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Grand total-----	657, 310, 500
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The bill as it passed the House contains authorization for 11 surveys in 8 States.

The Senate Public Works Committee, after the end of the fiscal year (August 4 and 21, 1959), held hearings but did not report the bill.

3. EXAMINATIONS AND SURVEYS

The Public Works Committees of Congress adopted 180 resolutions requesting review of previous reports on proposed improvements. In addition, acts of 1958 authorized 62 survey investigations.

Table 20. Reports Processed During Fiscal Year 1959 and Status at End of Year

Reports transmitted to—	Number
Congress.....	65
Bureau of the Budget.....	70
State and Federal agencies.....	70
River and harbor and beach erosion boards.....	85
Total actions.....	290
Status as of June 30, 1959	
Favorable reports before Congress.....	46
Reports in process in Office, Chief of Engineers.....	61
Active reports in field offices.....	270
Special studies active in field offices.....	10
Inactive reports in field offices.....	790
Special studies inactive in field offices.....	1
Total reports.....	1, 178

Current survey program. Public Law 85-500, sections 105 and 208, eliminated the need for preliminary examination reports. This and other improvements will provide more economical and faster production of survey reports. Further economies are anticipated from revised manuals of procedures. Interagency coordination continued. Several special studies that are elements of the survey program are discussed in subsequent paragraphs.

Developments in survey procedures. Preparation of engineering manuals on survey report procedures was continued. The omnibus authorization act approved July 3, 1958 (Public Law 500, 85th Cong.), authorized a single-stage survey report procedure. This was implemented by changes to EM 1120-2-101. Manuals and instructions on cost computation evaluation and sharing in major drainage, smallboat harbor, and hurricane flood protection projects were issued during the year.

Columbia River and tributaries review. The report of the Division Engineer, North Pacific Division, was completed early in fiscal year 1959. The review covers the entire field of water resource use, with studies of main-stem flood control, navigation, and power develop-

ment. Coordination has been maintained with Federal, State, and local agencies. The Board of Engineers for Rivers and Harbors prepared its report to the Chief of Engineers. Preparation of the report of the Chief of Engineers was in progress.

Delaware River comprehensive review. A comprehensive review of the report on the Delaware River published in House Document 179, 73d Congress, and related reports, authorized by Congress, was continued during the fiscal year. The President in 1956 directed a full and continuing exchange of information and views among all parties concerned. This is being accomplished by a coordinating committee with Federal, State, and local representation.

Comprehensive survey of Great Lakes harbors. The St. Lawrence Seaway and Great Lakes connecting channels projects will provide a waterway with minimum depth of 27 feet throughout the Great Lakes system, connecting with the Atlantic Ocean. Anticipated traffic into the Great Lakes through the deep-draft St. Lawrence Seaway, as well as the deeper draft traffic expected from improvement of connecting channels, necessitates reexamination of harbors on the Great Lakes. Such studies have been authorized. A comprehensive traffic study of waterborne commerce that will use the seaway and connecting channels is underway and scheduled for completion in June 1960. A total of 26 public hearings have been held. More than 50 harbors will be considered. Interim reports are being prepared on 34 harbors, and the remaining harbors will be covered in the final report scheduled for completion in March 1961. Reports on 14 harbors have been completed and submitted to Congress. These harbors are included in an omnibus bill which has passed the House of Representatives. Interim reports on 15 harbors are scheduled for completion by reporting officers during fiscal year 1960.

Hudson River siltation study. This authorized study will determine what improvements are necessary and feasible to lessen shoaling in pier slips along the Hudson River and the Federal channel at Edgewater, N.J. Movement of freight and docking of passenger liners are affected adversely by siltation. The investigations were continued and model studies are underway.

Hurricane flood protection study. Hurricanes of recent years have caused large loss of life and unprecedented damage to property. Public Law 71, 84th Congress, authorized study of the coastal and tidal areas along the eastern and southern seaboard to secure data on hurricanes, methods of forecasting their paths, improving warnings, and preventing loss of life and property. This study, being made in cooperation with Federal and State agencies, was continued during the fiscal year. Initial appraisals have been completed. Interim reports on some 40 areas were in progress.

Ohio River comprehensive review. An authorized comprehensive review of the Ohio River and tributaries has the objective of developing a program to serve the needs of the area. Coordination is being maintained with interested Federal, State, and local agencies. Studies of floods and projects were continued.

Potomac River comprehensive review. An authorized comprehensive review of the Potomac River and tributaries was continued. The objective of this review is development of a comprehensive, basinwide, water resource program. Attention to water supply and stream pollution comprises an important part of the study. Coordination is being maintained with Federal, State, and local agencies. An interim report on the North Branch basin was essentially completed. Congressional action has limited expenditure of funds during fiscal year 1960 to studies of water supply and pollution abatement only. Studies for flood control and other water uses will be dependent upon future appropriations.

Survey of the San Francisco Bay area. An authorized comprehensive survey of the San Francisco Bay area was in progress. The study will include navigation requirements, flood control, reclamation of marginal lands, water supply, salt water intrusion, sedimentation, and other water problems. The possibility of using dikes or barriers across the northern and southern portions of the bay for fresh water impoundment, and as causeways, is being investigated. Model studies are being used. Coordination is being maintained with State and local interests.

Mississippi River and tributaries project review. A comprehensive review of the project for flood control on the Mississippi River in the alluvial valley and for its improvement from the Head of Passes to Cape Girardeau, Mo., published in House Document 359, 77th Congress, was authorized June 12, 1954. This study involves reexamination of existing plans that have evolved over a period of more than 30 years to determine their adequacy and the need for and economic justification of any extensions or modifications of the authorized project. During fiscal year 1959 field investigations were essentially completed, and the necessary office studies for preparation of the report were in progress.

4. BOARD OF ENGINEERS FOR RIVERS AND HARBORS

The Board held eight meetings of 1 to 2 days' duration, and also two public hearings in and three outside of Washington, D.C. The Board considered 89 reports, acting favorably on 66 and unfavorably on 19, and deferred action on 4. The Board recommended authorization of projects estimated to cost \$1,646 million, of which \$1,607 million is the estimated cost to the United States, and \$39 million the

cost to local interests, including work to be done by local interests and cash contributions.

5. BEACH EROSION BOARD

This Board completed action on four beach erosion control studies (one combined with a hurricane survey report) in cooperation with local public agencies, and assisted State agencies in setting up a study program for nine new cooperative studies and an addition to a continuing study, as listed below.

LIST OF BEACH EROSION CONTROL COOPERATIVE STUDIES COMPLETED AND APPLICATIONS APPROVED

Cooperative Studies Completed During Year

Atlantic Coast of Long Island, N.Y.—Fire Island Inlet to Montauk Point (Suffolk County).

Barnegat Inlet to Cape May Canal, N.J.

Bolivar Peninsula (Gulf Shore at Rollover Fish Pass), Tex.

Pemberton Point to Cape Cod Canal, Mass.

Applications for Cooperative Studies Approved During Year

Atlantic Ocean shore of New Hampshire.

Belle Pass to Raccoon Point, La.

Falmouth, Mass.

Hills Beach, Biddeford, Maine.

Jones Inlet to Norton Point, Long Island and Staten Island, N.Y.

Point Delgada to Point Ano Nuevo, Calif. (continuing study).

Rockport, Mass.

Salisbury Beach, Mass.

Sheffield Lake Village, Ohio.

Virginia and Biscayne Keys, Miami, Fla.

Thirteen reports were reviewed for probable effects of navigation improvements on the adjacent shore lines. In addition, hurricane protection was considered in the combined report, Atlantic coast of Long Island, N.Y., and four other hurricane survey reports and one flood control design memorandum were reviewed.

Results of the research investigations conducted by the Board are made available to the using public in the form of publications. During the year, 10 technical memoranda and 2 miscellaneous papers were issued.

6. ADVANCE ENGINEERING AND DESIGN

During the preliminary phase of preparing authorized projects for construction, features thereof are developed, firm estimates of cost are prepared, orderly construction schedules are worked out, and necessary detailed information is readied for coordination with local interests and other agencies. A backlog of projects ready for initia-

tion of construction is in preparation to allow inclusion in the civil works construction program as the national budgetary policy permits, at the same time assuring the development of a sound and well-balanced program consistent with the Nation's needs.

With \$9,551,500 made available, together with funds carried over from prior years, planning was prosecuted on 128 projects, consisting of 21 navigation, 98 flood control, and 9 multiple-purpose projects. Planning on 36 of these projects was advanced to the stage where construction could be readily initiated. Funds in the amount of \$9,216,444, representing approximately 76 percent of the total available, were obligated.

The Corps of Engineers continued its program of investigating the means of improving design and construction procedures. The accomplishments and economies effected in this field of activity are set forth in the discussion of the civil works investigations program in chapter VI.

7. COLLECTION AND STUDY OF BASIC DATA

The collection and study of basic data are indispensable to the planning, design and operation of Corps river-basin projects for the development of the Nation's water resources. This item includes those cooperative activities performed by other Federal agencies for which funds are provided by the Corps of Engineers for the basic programs of observing, compiling, reporting, and publishing data on streamflow, rainfall, and fish and wildlife resources. A description of each of these activities during fiscal year 1959 is presented below:

a. Cooperative programs with U.S. Weather Bureau:

(1) Operation of a network of rainfall gages, primarily of the continuous recording type, known as the Hydroclimatic Network, was continued by the Weather Bureau at the request of the Corps of Engineers. Funds in the amount of \$450,000 were transferred to the Weather Bureau for continued operation of this network during fiscal year 1959. A total of 2,722 stations (2,269 recording and 453 nonrecording) were in operation in the network on June 30, 1959. Data from these stations are published monthly by the Weather Bureau in "Hourly Precipitation Data."

(2) The Hydrometeorological Section of the Weather Bureau was continued during the fiscal year at the request of the Corps of Engineers to review the meteorological aspects of the storm study program and to continue the development of theoretical concepts and practical techniques of estimating probable maximum precipitation for use in engineering design. Funds in the amount of \$115,000 were made available to the Weather Bureau to finance continued operation

of this section during fiscal year 1959. Accomplishments during the year included investigations relating to probable maximum precipitation in California and revision of the draft report thereon; estimates of probable maximum precipitation for seven project areas; review of several storm studies and other investigations involving meteorological phases of engineering problems.

(3) The River and Rainfall Reporting Networks, currently totaling 39 in number, were also continued at the request of the Corps in order that frequent reports of river stage and rainfall data would be available as required by District Engineers for flood control operation and flood-forecasting purposes. Funds in the amount of \$114,100 were transferred to the Weather Bureau for continuation of this program during fiscal year 1959.

b. Stream gaging program with the U.S. Geological Survey. The Geological Survey was requested to continue the cooperative program of constructing, maintaining, and operating stream-gaging stations required in connection with Corps of Engineers activities. A total of \$1,415,500 was transferred to the Geological Survey for operation of approximately 1,760 stations under this program during fiscal year 1959. Data obtained from these stations are published by the Geological Survey in the series of annual Water Supply Papers.

CHAPTER V

FUNDING TRENDS

1. FUNDS AVAILABLE FOR WORK

Fiscal year 1959 funds appropriated for civil works activities of the Corps of Engineers amounted to \$815,520,646. Individual appropriations are detailed in table 21. Status of the funds advanced by local interests for navigation and flood-control improvements is shown in table 22.

Table 21. Appropriations, Fiscal Year 1959

The funds with which the works for the maintenance and improvement of rivers and harbors and flood control were prosecuted during the fiscal year were derived from unexpended balances of prior appropriations and from the following appropriations acts, and by transfer from other departments.

Appropriation title	Date of act	Amount
PUBLIC WORKS APPROPRIATION ACT, 1959:	July 1, 1958	
Flood Control, Mississippi River and Tributaries.	-----	\$3, 713, 204. 37
General Investigations, Corps of Engineers, Civil.	-----	135, 000. 00
Construction, General, Corps of Engineers, Civil.	-----	2, 850, 000. 00
Operation and Maintenance, General, Corps of Engineers, Civil.	-----	2, 200, 000. 00
General Expenses, Corps of Engineers, Civil, 1958 and 1959.	-----	41, 112. 87
U.S. Section, Saint Lawrence River Joint Board of Engineers, Corps of Engineers, Civil, 1958 and 1959.	-----	500. 00
Total -----		8, 939, 817. 24
PUBLIC WORKS APPROPRIATION ACT, 1959:	Sept. 3, 1958	
Flood Control, Mississippi River and Tributaries.	-----	56, 097, 500. 00
General Investigations, Corps of Engineers, Civil.	-----	9, 053, 500. 00
Construction, General, Corps of Engineers, Civil.	-----	565, 396, 500. 00

Table 21. Appropriations, Fiscal Year 1959—Continued

Appropriation title	Date of act	Amount
Operation and Maintenance, General, Corps of Engineers, Civil.	-----	\$101, 170, 000. 00
General Expenses, Corps of Engineers, Civil, 1958 and 1959.	-----	10, 675, 000. 00
U.S. Section, Saint Lawrence River Joint Board of Engineers, Corps of Engineers, Civil, 1958 and 1959.	-----	89, 500. 00
Total-----	-----	742, 482, 000. 00
SUPPLEMENTAL APPROPRIATION ACT, 1959:	Aug. 27, 1958	
Operation and Maintenance, General, Corps of Engineers, Civil.	-----	70, 000. 00
JOINT RESOLUTION:	June 30, 1958	
Flood Control, Mississippi River and Tributaries.	-----	8, 000, 000. 00
General Investigations, Corps of Engineers, Civil.	-----	1, 000, 000. 00
Construction, General, Corps of Engi- neers, Civil.	-----	35, 000, 000. 00
Operation and Maintenance, General, Corps of Engineers, Civil.	-----	10, 000, 000. 00
General Expenses, Corps of Engineers, Civil, 1958 and 1959.	-----	1, 000, 000. 00
U.S. Section, St. Lawrence River Joint Board of Engineers, Corps of Engineers, Civil, 1958 and 1959.	-----	10, 000. 00
Total-----	-----	55, 010, 000. 00
SECOND SUPPLEMENTAL APPRO- PRIATION ACT, 1959:	May 20, 1959	
Construction, General, Corps of Engi- neers, Civil.	-----	5, 000, 000. 00
Operation and Maintenance, General, Corps of Engineers, Civil.	-----	1, 081, 100. 00
General Expenses, Corps of Engineers, Civil, 1958 and 1959.	-----	1, 018, 700. 00
Total-----	-----	7, 099, 800. 00
RESTORATIONS:	Dec. 1, 1958	
U.S. Section, St. Lawrence River Joint Board of Engineers, Corps of Engi- neers, Civil, 1958.	-----	877. 78

Table 21. Appropriations, Fiscal Year 1959—Continued

Appropriation title	Date of act	Amount
ADJUSTMENT WARRANT:	Aug. 12, 1958	
Claims, Lake of the Woods Flood Damage, Corps of Engineers, Civil.	-----	—\$50. 00
CLAIMS FOR DAMAGES ACT Aug. 12, 1958:	Aug. 12, 1958	
Claims, Lake of the Woods Flood Damage, Corps of Engineers, Civil.	-----	243, 633. 49
SPECIAL FUNDS:		
Hydraulic Mining in California, Debris Fund.	June 19, 1954.---	18, 000. 00
Payments to States, Flood Control Act, June 28, 1938, as Amended.	June 28, 1938.---	1, 504, 191. 94
Maintenance and Operation of Dams and Other Improvements to Navigable Waters (Credits to Accounts from Licenses under Federal Water Power Act, Aug. 26, 1935).	Aug. 26, 1935.---	152, 375. 93
TRUST FUNDS (CONTRIBUTIONS AND ADVANCES):		
Rivers and Harbors Contributed Funds.	Various-----	12, 244, 291. 98
Rivers and Harbors Advanced Funds--	-----do-----	32, 000. 00
Total-----	-----	12, 276, 291. 98
FUNDS TRANSFERRED FROM OTHER DEPARTMENTS:		
Disaster Relief, Executive, Office of the President (Transfer to Corps of Engineers, Civil).	-----do-----	—890, 535. 56
Salaries and Expenses, Office of Civil Defense Mobilization (Transfer to Corps of Engineers, Civil), 1958 and 1959.	-----do-----	22, 600. 00
Technical Cooperation, General, Executive (Transfer to Corps of Engineers, Civil).	-----do-----	—3, 482. 37
Technical Cooperation, General, Executive (Transfer to Corps of Engineers, Civil), 1957.	-----do-----	—36, 718. 82
Technical Cooperation, General, Executive (Transfer to Corps of Engineers, Civil), 1958.	-----do-----	63, 221. 47
Technical Cooperation, General, Executive (Transfer to Corps of Engineers, Civil), 1959.	-----do-----	22, 000. 00

Table 21. Appropriations, Fiscal Year 1959—Continued

Appropriation title	Date of act	Amount
FUNDS TRANSFERED FROM OTHER DEPARTMENTS—Continued		
Southeast Asia and Western Pacific, Executive (Transfer to Corps of Engineers, Civil), 1955.	-----do-----	—\$3, 552. 73
Defense Support, General, Executive (Transfer to Corps of Engineers, Civil), 1958.	-----do-----	8, 413. 32
Defense Support, General, Executive (Transfer to Corps of Engineers, Civil), 1959.	-----do-----	10, 000. 00
Defense Support, Asia, Executive (Transfer to Corps of Engineers, Civil), 1957.	-----do-----	—14, 428. 38
Commodity Credit Corporation Fund (Transfer to Corps of Engineers, Civil).	-----do-----	—6, 851. 54
Construction, Bureau of Sport Fisheries and Wildlife (Transfer to Corps of Engineers, Civil).	-----do-----	1, 300, 000. 00
Construction, Bureau of Indian Affairs (Transfer to Corps of Engineers, Civil).	-----do-----	1, 500, 000. 00
Passamaquoddy Tidal Power Survey (Transfer to Corps of Engineers, Civil).	-----do-----	453, 459. 84
Salaries and Expenses, National Science Foundation (Transfer to Corps of Engineers, Civil).	-----do-----	—55, 000. 00
U.S. Dollar Advances From Foreign Governments, U.S. Educational Exchange Program, State (Transfer to Corps of Engineers, Civil).	-----do-----	8, 575. 62
Capital Outlay, U.S. Soldiers' Home (Transfer to Corps of Engineers, Civil), 1959 and 1960.	-----do-----	128, 000. 00
Total-----	-----do-----	2, 505, 700. 85
Grand total all funds-----	-----do-----	830, 302, 639. 21

Table 22. *Advanced Funds*

The following amounts have been advanced by local interests for river and harbor improvements under the provisions of sec. II, River and Harbor Act, Mar. 3, 1925, and for flood control works under the provisions of the act of Oct. 15, 1940, and are returnable to the same interests when necessary Government funds are available.

	District	Balance due from United States, June 30, 1958	Amount received during fiscal year	Amount returned during fiscal year	Balance due from United States, June 30, 1959
Selkirk—shore protection	Buffalo-----	\$5, 000	-----	-----	\$5, 000
Imperial Beach, Calif.---	Los Angeles-----	-----	\$32, 000	-----	32, 000
Jones Beach Inlet, N.Y.---	New York-----	337, 500	-----	\$337, 500	-----
Total rivers and harbors.	-----	342, 500	32, 000	337, 500	37, 000

2. ANNUAL APPROPRIATIONS

Chart IV indicates the fluctuation in annual appropriations since 1949 for civil works functions. Chart V shows actual appropriations adjusted to reflect rising construction costs for the past 10 years. Although actual appropriations for fiscal year 1959 represent an increase of 28 percent over 1950, application of the Engineering News-Record's cost of construction index to the 1959 appropriation shows a decrease of 23 percent in the amount of work which the appropriation could produce as compared to the considerably lower appropriation a decade ago.

ACTUAL APPROPRIATIONS - CIVIL WORKS FUNCTIONS
FY 1949 - 1959 INCL.

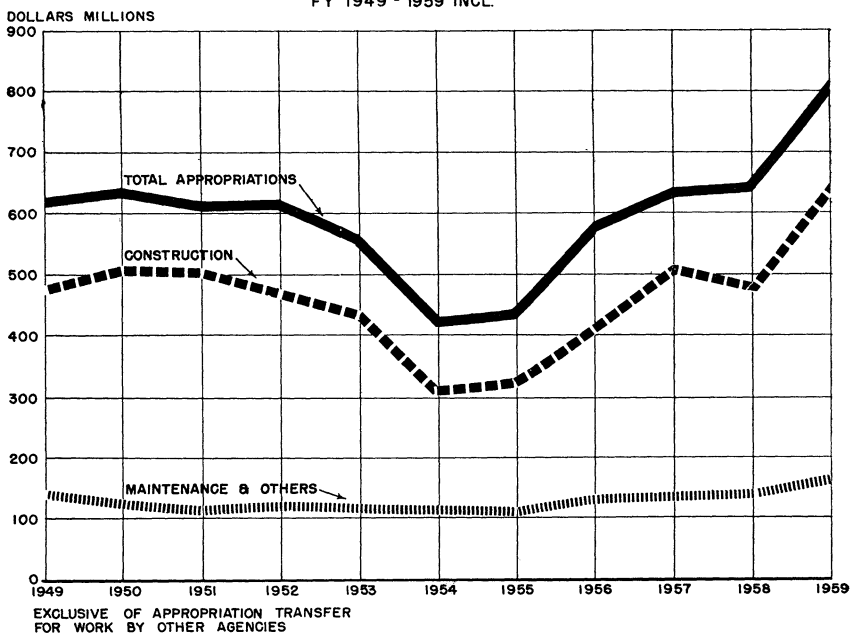


Chart IV

ADJUSTED APPROPRIATIONS - CIVIL WORKS FUNCTIONS
FY 1949 - 1959 INCL.

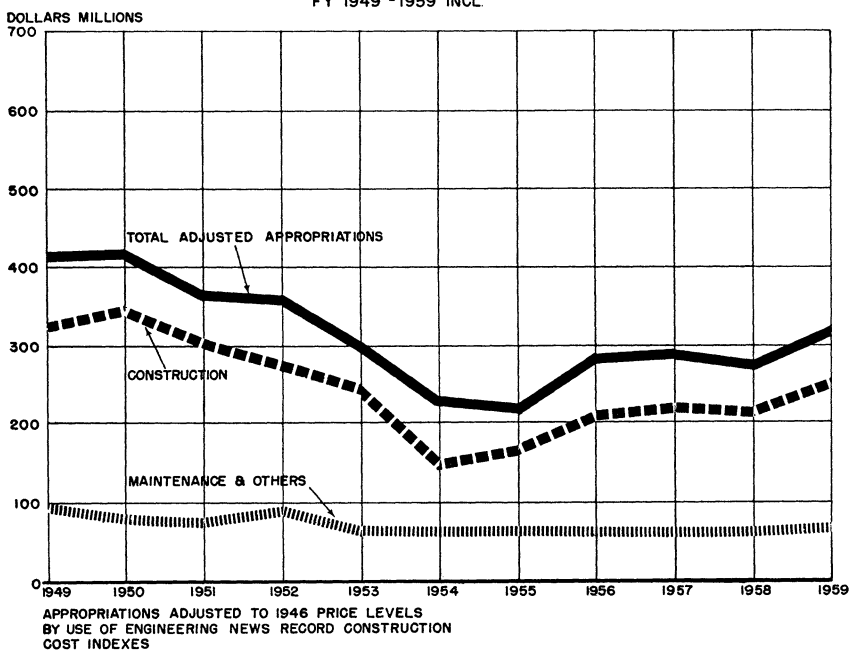


Chart V

3. EXPENDITURES (COSTS)

During fiscal year 1959 expenditures (costs) amounted to \$796,415,873 on the civil works program. Of this amount, \$630,684,871 was for construction and \$165,731,002 for all other activities except those funded by contingencies, advances, and collections from local sources and transfers from other agencies. Chart VI shows comparative expenditure (cost) data since 1953. Expenditures under each appropriation are listed in table 23.

EXPENDITURES (COST) — CIVIL WORKS FUNCTIONS

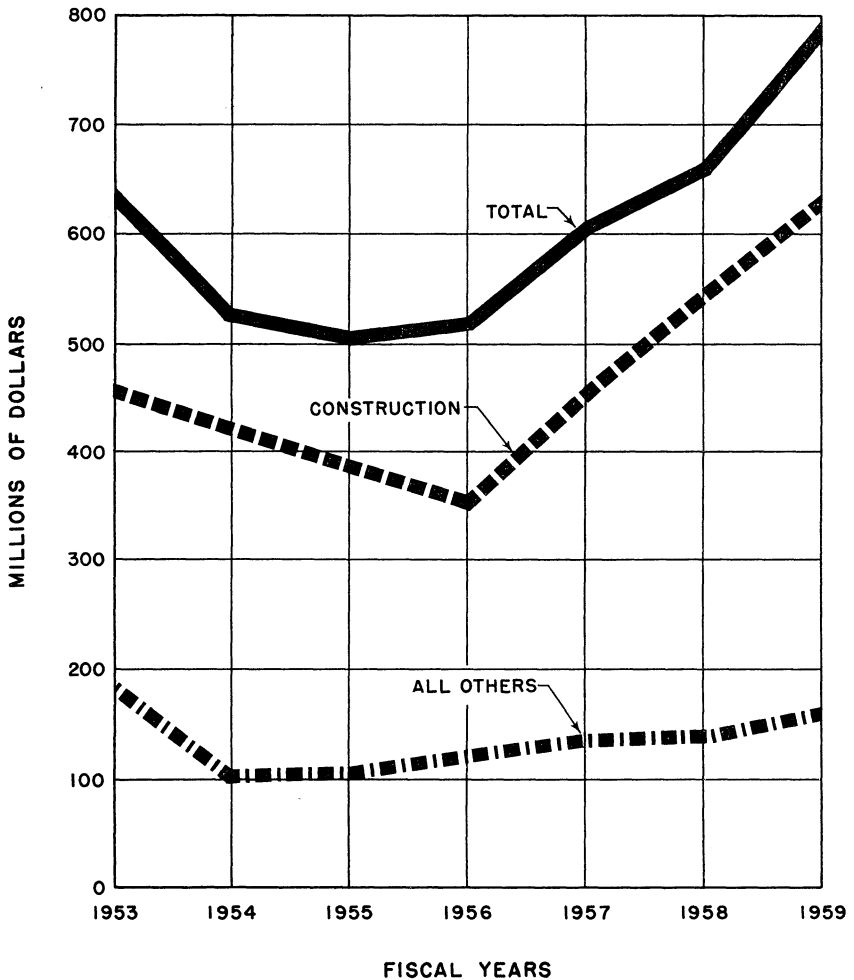


Chart VI

Table 23. *Accrued Expenditures, Fiscal Year 1959*

The total actually expended under the direction of the Chief of Engineers in connection with the maintenance and improvement of rivers and harbors, flood control, and other miscellaneous works during the fiscal year ended June 30, 1959, as follows:

Appropriation title	Amount
RIVERS AND HARBORS AND FLOOD CONTROL:	
Flood Control, Mississippi River and Tributaries.....	\$72, 884, 203. 05
General Investigations, Corps of Engineers, Civil.....	10, 759, 308. 88
Construction, General, Corps of Engineers, Civil.....	582, 992, 753. 57
Operation and Maintenance, General, Corps of Engineers, Civil.....	115, 159, 229. 18
General Expenses, Corps of Engineers, Civil, 1957.....	—18. 46
General Expenses, Corps of Engineers, Civil, 1958.....	72, 929. 16
General Expenses, Corps of Engineers, Civil, 1958 and 1959.....	12, 630, 603. 86
Maintenance and Operation of Dams and Other Improvements to Navigable Waters.....	152, 127. 30
Total rivers and harbors and flood control.....	794, 651, 136. 54
MISCELLANEOUS APPROPRIATIONS:	
Niagara Remedial Works, Corps of Engineers, Civil.....	51. 73
U.S. Section, St. Lawrence River Joint Board of Engineers, Corps of Engineers, Civil, 1958.....	877. 78
U.S. Section, St. Lawrence River Joint Board of Engineers, Corps of Engineers, Civil, 1958 and 1959.....	27, 011. 38
Claims, Lake of the Woods Flood Damage, Corps of Engineers, Civil.....	243, 583. 49
Hydraulic Mining in California, Civil.....	21, 261. 48
Payments to States, Flood Control Act of 1954.....	1, 471, 951. 07
Total miscellaneous appropriations.....	1, 764, 736. 93
CONTRIBUTED AND ADVANCED FUNDS:	
Rivers and Harbors Contributed Funds.....	13, 304, 774. 99
Rivers and Harbors Advanced Funds.....	338, 711. 43
Total contributed and advanced funds.....	13, 643, 486. 42
Total engineer department and contributed funds.....	810, 059, 359. 89
TRANSFERS FROM OTHER DEPARTMENTS:	
Disaster Relief, Executive Office of the President (Transfer to Corps of Engineers, Civil).....	396, 249. 86
Salaries and Expenses, Office of Civil and Defense Mobilization (Transfer to Corps of Engineers, Civil), 1958 and 1959.....	22, 236. 33
Technical Cooperation, General, Executive (Transfer to Corps of Engineers, Civil).....	3, 225. 48

Table 23. *Accrued Expenditures, Fiscal Year 1959—Continued*

Appropriation title	Amount
TRANSFERS FROM OTHER DEPARTMENTS—Con.	
Technical Cooperation, General, Executive (Transfer to Corps of Engineers, Civil), 1957-----	—\$1, 541. 03
Technical Cooperation, General, Executive (Transfer to Corps of Engineers, Civil), 1958-----	42, 054. 63
Technical Cooperation, General, Executive (Transfer to Corps of Engineers, Civil), 1959-----	850. 00
Southeast Asia and Western Pacific, Executive (Transfer to Corps of Engineers, Civil), 1955-----	—42. 61
Defense Support, General, Executive (Transfer to Corps of Engineers, Civil), 1958-----	5, 238. 89
Defense Support, General, Executive (Transfer to Corps of Engineers, Civil), 1959-----	880. 55
Defense Support, Asia, Executive (Transfer to Corps of Engineers, Civil), 1957-----	—250. 00
Construction, Bureau of Sport Fisheries and Wildlife (Transfer to Corps of Engineers, Civil)-----	1, 110, 077. 43
Construction, Bureau of Indian Affairs (Transfer to Corps of Engineers, Civil)-----	1, 000, 867. 64
Passamaquoddy Tidal Power Survey (Transfer to Corps of Engineers, Civil)-----	429, 964. 54
Salaries and Expenses, National Science Foundation (Transfer to Corps of Engineers, Civil)-----	38, 798. 77
U.S. Dollar Advances from Foreign Governments, U.S. Educational Exchange Program, State (Transfer to Corps of Engineers, Civil)-----	8, 891. 61
Maintenance and Operations, U.S. Soldiers' Home (Transfer to Corps of Engineers, Civil), 1957-----	4, 825. 00
Capital Outlay, U.S. Soldiers' Home (Transfer to Corps of Engineers, Civil)-----	1, 371, 374. 77
Capital Outlay, U.S. Soldiers' Home (Transfer to Corps of Engineers, Civil) 1959 and 1960-----	28, 070. 22
Total transfers from other departments-----	4, 461, 772. 08
WORKING FUNDS:	
Consolidated Working Fund, Army, Engineers, Civil (Trust Fund)-----	979. 58
Grand total—accrued expenditures by engineer department-----	814, 522, 111. 55

CHAPTER VI

OTHER CIVIL WORKS ACTIVITIES

1. ST. LAWRENCE SEAWAY

By letter dated September 17, 1954, addressed to the Secretary of the Army, the St. Lawrence Seaway Development Corporation designated the Corps of Engineers as its agent for design and construction of the seaway project. The Corporation was created on May 13, 1954, under authority of Public Law 358, 83d Congress, 2d session.

The project involves construction of navigation facilities in U.S. waters in the reach of the St. Lawrence River which constitutes the boundary between the United States and Canada, and coordination thereof with the power facilities to be constructed concurrently by others.

The major features of the project are complete except for channel dredging in the South Cornwall Island section. All completed features have been transferred to the St. Lawrence Seaway Development Corporation for operation. The contracting authority of the Corps of Engineers was terminated on December 31, 1958, and all cost and fiscal responsibilities were assumed by the Seaway Corporation on January 1, 1959. The Corps will continue supervision and inspection of contract work scheduled to be completed December 1, 1959, and hired labor operations until project completion which is scheduled for December 31, 1960.

For detailed report on the St. Lawrence Seaway, see volume 2, Buffalo District, page 1480.

2. ST. LAWRENCE RIVER JOINT BOARD OF ENGINEERS

This Board, having United States and Canadian sections, was created pursuant to the order of approval issued by the International Joint Commission on October 29, 1952. The U.S. section was established and its duties defined by Executive order issued November 4, 1953. Members of the U.S. section are the Secretary of the Army and the Chairman of the Federal Power Commission, with Major General C. G. Holle (special assistant to the Chief of Engineers until his retirement on October 31, 1958, and retained on a consultant basis after that date) and Mr. F. L. Adams, Chief of the Bureau of Power of the Federal Power Commission, as alternates.

The duties of the Board are to review and approve, in behalf of both Federal governments, the plans, specifications, and work schedules for the power project in the International Rapids section of the St. Lawrence River, and to inspect construction operations to insure conformance with Board approvals. The power project is being constructed jointly by the Power Authority of the State of New York and The Hydro-Electric Power Commission of Ontario. Supervision of construction pursuant to the Federal Power Commission license issued July 15, 1953, to the Power Authority of the State of New York also was assigned to the U.S. section, thus integrating these two Federal supervisory activities.

A small engineering staff to support the U.S. section was established in Massena, N.Y., with Washington liaison. In consideration of the advanced stage of completion of the power project, the Massena office was closed on August 8, 1958, with staff support thereafter being provided in the Office of the Chief of Engineers and the Washington office of the Federal Power Commission.

Costs of the U.S. section through June 30, 1959, totaled about \$422,000. An additional \$39,000 was appropriated to finance the activities of the U.S. section during fiscal year 1960. All costs of the U.S. section are subject to reimbursement by the Power Authority of the State of New York, as provided in the appropriation acts.

3. FLOOD-FIGHTING AND OTHER EMERGENCY OPERATIONS

Emergency flood-control activities, involving advance preparation for flood emergencies, flood rescue work, flood fighting, and the repair and restoration of flood control works damaged or destroyed by flood, were carried on during the year under the Corps' statutory authority set forth in Public Law 99, 84th Congress, and prior legislation. The fiscal year expenditures from the emergency fund totaled \$6,573,259, not including replacement of other funds temporarily used for prior-year work. In addition, disaster assistance and engineering services were made available as authorized and directed by the Office of Civil and Defense Mobilization, successor agency to the Federal Civil Defense Administration, in accordance with the procedures established pursuant to Public Law 875, 81st Congress (Federal Disaster Act of 1950). The most noteworthy flood emergencies and emergency operations during the fiscal year are described in the following paragraphs.

Operations in connection with disasters occurring during prior fiscal years. Final report on Operation NOAH, covering disaster recovery operations in the Northeastern States initiated in fiscal year 1956, was published. In North Carolina, work was essentially completed on the program authorized by OCDM for clearing and snag-

ging natural channels in recovery from hurricane and storm disasters of calendar years 1955-56.

July 1958 flood, western Iowa. An intense rainstorm on July 1-2, caused one of the most disastrous floods ever experienced in the Nishnabotna River Basin, in southwest Iowa. Flash flooding exacted a toll of 19 lives. Over 65,000 acres were inundated to depths generally ranging from 5 to 8 feet, with as much as 11 feet reported in the Exira area, where 15 persons were drowned. Flood damages of \$5,682,700 are estimated to have occurred, exclusive of \$5 million damages from erosion and loss of soil. The President on July 5, 1959, exercised the authority of Public Law 875 and made a "major disaster" determination as prerequisite for provision of Federal assistance under that law. Supplementing the efforts of local interests and other organizations, disaster assistance was also provided by the Corps of Engineers under its own authority, Public Law 99; the Omaha District dispatched a complement of 4 military and 180 civilian technicians, 33 cars and trucks, 6 boats, 6 lighting plans, 7 radio units, 107,000 sandbags, and 53,000 board feet of lumber. These forces were applied to flood fighting work; a postflood program was undertaken for emergency repair of levees damaged in this flood and flood flows occurring later in August and September.

July 1958 floods, other midwestern and eastern areas. Major flooding occurred in several streams of Iowa, Illinois, Kansas, Missouri, and Nebraska. In Iowa, within the Des Moines River Basin, record stages were exceeded on the lower Raccoon River from the storm of July 1-2 and the Des Moines River rose above flood stage, with damage principally agricultural. In Illinois, major floods affected about 10,000 acres of cropland in the Illinois River, the Sangamon River, and also the Kaskaskia River. In Kansas, Frankfort, in the Kansas River Basin, was inundated by the Black Vermillion River to a depth of 4 feet; Atchison was severely flooded twice with damages estimated at \$4 million; and considerable flooding occurred in the Arkansas River Basin with a record stage at Great Bend and a near-record stage at Hutchinson. In Northern Missouri, flooding was especially severe in the Grand River Basin and on the lower Missouri River, which reached its highest level since 1951. In Nebraska, flooding occurred in streams of the Salt River and the Papillion River Basins. Flooding on the Shenango River, in the vicinity of Sharon, Pa., was the worst since 1913 and resulted in damages estimated as approaching \$4 million. Presidential "major disaster" declarations were made under Public Law 875 on August 5 and November 6, 1959, for the affected areas of Kansas. Under Public Law 99, flood-fighting assistance was furnished by the Corps of Engineers at various localities and damaged flood control works were repaired and restored.

September 1958 floods in Texas. Excessive rainfall in northeastern Texas caused considerable flash flooding within the Trinity River Basin on Richland, Chambers, and Cedar Creek watersheds, with heavy agricultural damage. Assistance was given local interests in repair and restoration of damaged levees under Public Law 99 authority.

November 1958 flood in western Washington. Heavy rains caused major flooding in the Green, Snohomish, Snoqualmie, and Stillaguamish River Basins, with a record crest on the Stillaguamish River and a near-record stage on the Snohomish River. In the lower Snohomish Valley, 6,500 acres of farm and pasture land were inundated. Damaging flows also occurred on the Nooksack and Skagit Rivers.

January–February 1959 floods in Indiana, Ohio, and Pennsylvania. Disastrous flooding occurred in January northward of the Ohio River as a result of heavy rainfall upon frozen ground and snow cover, augmented by ice jam blockage on some streams. Record to near-record stages were reached along several rivers. Flooding was most severe in the Whitewater Basin and small Ohio River tributaries in Indiana; the Scioto, Muskingum, and Sandusky River Basins in Ohio; and the Beaver River and upper Alleghany River Basins in Pennsylvania. The February floods affected some areas severely damaged in January, but mainly affected the Wabash River Basin in Indiana, where flooding was the greatest in 46 years at numerous points, with complicating huge ice jams. There was severe flooding in the Maumee River Basin in Ohio. In addition to the Wabash River, ice jams were particularly troublesome on the Sandusky River in Ohio and on French Creek above Meadville, Pa. Estimates of flood damages from the January–February floods indicate that over \$117 million of the damages occurred within the Ohio River Basin, with additional damages of several million dollars on streams in the Great Lakes drainage area. The President on January 23, 1959, made “major disaster” declarations under Public Law 875 with respect to the affected areas of Ohio and Pennsylvania, and on January 23 and February 13 made similar declarations regarding Indiana. Under Public Law 99, the Corps of Engineers participated in flood-fighting and rescue work and provided technical assistance at many locations, particularly on ice-jam problems; an extensive emergency program was undertaken in Indiana and Ohio, providing assistance to the local interests in repair and restoration of the numerous levees damaged or destroyed. Assistance was also furnished OCDM in processing of applications for restoration of publicly owned facilities under Public Law 875.

May-June 1959 floods in Missouri and Arkansas River Basins. During May, major flooding occurred in the Kansas River Basin on the Black Vermillion River at Frankfort, Kans., where a near-record crest occurred. Large agricultural areas were flooded in June along the lower Missouri River and in the tributary Grand and Chariton River Basins, but damage was not severe. In the Arkansas River Basin, severe flooding occurred during May in the Cottonwood and Walnut Rivers, Kans., and disastrous flooding in the Washita River Basin, Okla. In Oklahoma, floods reoccurred in June, and the President declared the areas affected by the May-June floods to be sufficiently damaged to warrant Federal assistance under Public Law 875.

4. ADMINISTRATION OF LAWS FOR PROTECTION OF NAVIGABLE WATERS

In administering the Federal laws enacted for the protection and preservation of the navigable waters of the United States, 6,707 permits for structures or operations in navigable waters were issued and plans for 162 bridges, dams, dikes, or causeways were approved during the year. In addition, 32 extensions of time for commencement or completion of construction of bridges were granted. Sixty-six sets of regulations for the use, administration, and navigation of navigable waters were established, including drawbridge regulations, establishment of anchorage grounds, special anchorage areas, danger zones, and restricted areas.

The Corps of Engineers engaged in the following additional activities relative to the administration of the laws for the protection of navigable waters: Investigations of the discharge or deposit of refuse matter of any kind in navigable waters; prevention of pollution of coastal navigable waters by oil; administrative determination of the heads of navigation and the extent to which the laws shall apply to specific streams; supervision of the harbors of New York, Hampton Roads, and Baltimore to prevent obstructive or injurious deposits in the waters thereof, including the waters of Long Island Sound; establishment of reasonable rates of toll for transit across bridges over navigable waters; granting of permits for the occupation and use of Federal works under control of the Corps of Engineers; reports of international boards on operations affecting international boundary waters; and legislation in connection with the foregoing.

There is a continuing program to prevent deposits or to obtain the removal of any deposits in channels which obstruct navigation or increase Federal maintenance costs. In all areas of the country, most industries and municipalities are removing, or are participating in the

cost of removal of shoals for which they are responsible. All waterways are being observed and negotiations commenced with any company or municipality which may be causing shoaling due to waste deposits. During the past few years agreements averaging approximately \$1 million per year have been reached with some of our major industries. The program has resulted not only in a saving in dredging costs of approximately \$4 million and more efficient use of dredging equipment, but also in a stimulation of planning by the industries to improve their operations for recovering salvageable material. In the case of one company, which declined to accept responsibility for its deposits in the Calumet River, Ill., court action was instituted in 1954. Decree was entered on June 24, 1957, by the District Court in favor of the United States. The defendant was ordered to stop the deposit of materials and to remove the accumulation within 6 months. The defendant appealed the case and on January 22, 1959, the court of appeals reversed the district court. On June 1, 1959, the Supreme Court agreed to review the case.

A report entitled "Navigational Clearance Requirements for Highway and Railroad Bridges" prepared by the U.S. Department of Commerce was released in 1955. The conflicting interests involved are the desire of navigation interests for the maximum navigation opening and the desire of bridge owners to conserve funds by building a minimum crossing. In connection with its continuing studies of the problems involved at intersections of highway and water traffic, the Corps of Engineers is making a thorough review of its policy on bridge clearances with a view to resolving problems involved in meeting the requirements of both the water and land transportation interests. The present system of standard bridge clearances is being reviewed and extended to cover, so far as practicable and necessary, all navigable waterways. During the fiscal year 1959, review of the standard bridge clearances for the entire Gulf Intracoastal Waterway, the Atlantic Intracoastal Waterway, and the Missouri River was continued. Four public hearings have been held, one for each section of the Intracoastal Waterway and two for the Missouri River, divided into the lower and upper river at Gavins Point Dam.

The procedure whereby a "findings of fact" is prepared for attachment to the formal approval of bridge plans was continued. When necessary or in controversial cases, an economic analysis to assist in determination of the clearance requirements for a bridge may be developed. Toward the end of fiscal year 1956, the Secretary of the Army gave his advance approval to the location and plans of bridges across reaches of waterways navigable in law but not actually navigated other than by logs, log rafts, rowboats, canoes, or small motor-

boats. Action has been implemented to set up a procedure for administering this advance approval and delineating these proposed reaches.

Under the Bridge Alteration Act (Truman-Hobbs) approved on June 21, 1940, as amended by the act of July 16, 1952, the cost of altering a bridge used for railroad traffic, combined railroad and highway traffic or a publicly owned highway bridge, found by the Secretary of the Army to be obstructive to navigation, is apportioned between the bridge owner and the United States. Hearings in connection with obstructive qualities are held to determine if the bridge is an unreasonable obstruction to navigation. During fiscal year 1959 no hearings were held on obstructive bridges. Initial funds were made available for commencement of alteration of two bridges and additional funds have been made available for continuation of alteration on four bridges. Action was continued on seven additional obstructive bridge cases in various stages of development.

The removal of wrecks in navigable waters of the United States is governed by sections 19 and 20 of the River and Harbor Act approved March 3, 1899, and is predicated entirely upon their being obstructions to navigation. During the fiscal year, 71 wrecks were removed by the Corps of Engineers as obstructions to navigation.

5. REGULATION OF HYDRAULIC MINING, CALIFORNIA

The California Debris Commission, created by act of Congress, regulates hydraulic mining in the drainage area of the Sacramento and San Joaquin Rivers to prevent the resulting debris from being carried into navigable waters. The Commission has licensed 13 mining operators, of which 2 utilize storage behind the Federal debris dams.

During the year the Harry L. Englebright Dam and the North Fork Dam, together with their appurtenant service facilities, were operated and maintained for the storage of hydraulic mining debris.

In addition, the existing boat ramp at Harry L. Englebright Dam was paved with concrete. Provision of a new parking area, area lighting, and a water supply system was accomplished at the North Fork Dam.

Bank restoration and stone protection along the right and left banks of Yuba River, near Marysville, was accomplished by contract. The cost of this activity is paid in part from funds provided from receipts of required contributed funds. In addition to the above contributed funds, \$66,591 deferred maintenance funds were expended on the Yuba River project during fiscal year 1959.

6. CIVIL WORKS INVESTIGATION PROGRAM

A total of 83 studies and tests leading to development of more reliable engineering design data, utilization of superior or less costly construction materials, and improvements in construction and maintenance procedures for civil works projects were continued under the civil works investigation program, with 8 of these studies being completed during the year. Of the total program cost of \$1,230,322 for fiscal year 1959, approximately 74 percent was expended at the U.S. Army Engineer Waterways Experiment Station, principally in the fields of hydraulics, concrete and soils mechanics, and 7 percent by the Beach Erosion Board. The balance of the work was carried out by various Corps field offices. Benefits realized from the investigation program include more precise engineering designs, improvements in design methods, and direct and indirect savings in project construction and maintenance costs.

Examples of typical investigations include—

Field exposure stations. The ultimate test of the durability of concrete is its performance under the exposure conditions which it is to serve. The Waterways Experiment Station maintains two permanent exposure stations: one for severe weathering at Treat Island near Eastport, Maine, and one for mild weathering at St. Augustine, Fla. At each station specimens are stored at midtide height so that they get two cycles a day of wetting in salt water and drying. In addition, at Treat Island during the winter months they are subjected to two daily cycles of freezing and thawing in a saturated condition. Comparison with the results from these field stations makes possible the evaluation of laboratory tests for the rapid determination of durability. The stations have also provided direct information on the durability of particular cement-aggregate combinations, the amount of concrete cover required to prevent corrosion of reinforcing steel, and the effect of severe weathering on prestressed concrete beams.

Concrete culvert design. The thickness of the top, bottom, and sides of concrete box culverts under high fills is governed, under conventional design procedures, by the shear forces which accompany the dead and live loads imposed on the structure. The limited amount of information previously available on the shear strength of concrete necessitated the use of conservative design criteria and resulted in overdesign of the culverts. A study was carried out by the University of Illinois to explore the stresses and deflections of concrete box culverts under combined shear and bending forces, and to develop more realistic design criteria. Application of the results will permit reduction in size of the members as compared with previous designs, at

no significant sacrifice in safety and with consequent reduction in construction costs.

Development of hydraulic design standards. Under the sponsorship of the civil works investigation program, a special group has been established at the Waterways Experiment Station, Vicksburg, Miss., to collect and analyze experimental data in the field of hydraulics, formulate new and improved design standards from the experimental data, and disseminate this information periodically to all Corps offices engaged in the design of civil works projects. Thus much duplication of effort on the part of district offices is avoided and the offices are kept abreast of the times in their design methods. In carrying out this function, this group advises district offices on needed field observations and helps districts to obtain this information, coordinating the efforts of all districts in this respect and thus again avoiding duplication on the part of the districts. Model and field data are analyzed to determine general laws for use in design and also to provide information on the accuracy of model tests used in the design of Corps projects. With this information, it is possible to increase the accuracy of future model testing and predict more accurately the performance of the full-size structure. The design principles which are developed are put in chart form and issued periodically to Corps offices and to other Government and private agencies requesting them. Design charts have been issued on open-channel discharge; air entrainment in open channels and closed conduits; the design of spillway crests, chutes, and stilling basins; the design of outlet conduits and tunnels; discharge coefficients of spillway gates and outlet control valves; bridge pier hydraulic losses; and wave runoff on dams.

7. U.S. LAKE SURVEY

The U.S. Lake Survey, under its authorized project, continued the program of preparing, revising, and distributing navigation charts of the Great Lakes and their outflow rivers, the New York Canals system, Lake Champlain, and the Minnesota-Ontario border lakes, and the study of all matters affecting the hydraulics and hydrology of the Great Lakes system. The Great Lakes Pilot and seven supplements thereto were compiled and issued to complement the navigation information on the charts.

Offshore sounding of Lake Superior was completed. Offshore soundings were accomplished in northern Lake Michigan and western Lake Erie. Sweeping operations were conducted in western Lake Erie, northern Lake Michigan, and in the Straits of Mackinac.

Inshore soundings were conducted along the shoreline of Lake Huron from North Albany Point to the vicinity of Hammond Bay.

A joint survey with the Canadian Hydrographic Service in Lake St. Lawrence was started.

Revisory surveys were accomplished in all U.S. harbors on the eastern and western ends of Lake Erie and on Lake Ontario, along the St. Clair-Detroit River system and the Niagara and St. Lawrence Rivers, on Lake Champlain, along the New York canals system, and in the harbors on the southern and southwestern shores of Lake Michigan.

Maintenance of the vertical control network was accomplished. First-order levels on the St. Lawrence and Niagara Rivers were completed. First-order levels on the Detroit River were begun. Nineteen special water level gages were installed and maintained in selected harbors in Lake Michigan, Lake Erie, and Lake Ontario for verifying vertical control datum and furnishing data for crustal movement study.

In addition, lake and river level, hydraulic, hydrologic, and artificial factor data were collected, reduced, tabulated, and disseminated. Engineering and scientific analyses were made of these data for the benefit of navigation, Corps of Engineers activities, and other public, commercial, and industrial interests. Consulting engineer services were furnished to Corps of Engineers organizations and to the various international commissions, boards, and committees concerned with the Great Lakes and their outflow rivers, including the St. Lawrence River. Data pertaining to Great Lakes hydraulics and hydrology which are published regularly by the U.S. Lake Survey include monthly bulletins of Great Lakes levels, a hydrograph of monthly mean levels of the individual Great Lakes, tabulations of precipitation on the lake basins; diversions of water into, between, and from the lakes; flows in the connecting rivers; and long-range forecasts of lake levels.

8. WASHINGTON, D.C., WATER SUPPLY

With funds appropriated for the District of Columbia, the Corps of Engineers continued the operation, maintenance, repair, and protection of the water-supply facilities, known as the Washington Aqueduct, to provide an uninterrupted and adequate supply of purified water to the distribution systems of the District of Columbia and adjacent Maryland and Virginia areas as authorized by law. The maximum daily consumption provided by the existing facilities was 254 million gallons and the average daily consumption was 153 million gallons.

In order to meet the future demands for water, construction work continued on the long-range program. Construction of the Dalecarlia

finished-water pumping station with an installed capacity of 477 million gallons daily has been completed and this facility was placed in operation on April 30, 1959. Construction of the Little Falls raw-water pumping station has been substantially completed and the one 50-million-gallon-per-day and four 100-million-gallon-per-day pumping units installed therein are undergoing test run operations. A contract for the construction of a reinforced-concrete fishway through the new Little Falls Diversion Dam at Snake Island, in conformance with criteria established by the Fish and Wildlife Service, was awarded in November 1958. The work is scheduled to be completed in December 1959. The final plans and specifications for the Dalecarlia filter and chemical buildings are nearing completion and construction work on these facilities will be started during fiscal year 1960. A large orifice plate meter will be installed in fiscal year 1960 in the 9-foot circular conduit conveying water to the Georgetown Reservoir.

9. WORK FOR OTHER AGENCIES

Dredging operations were carried out during fiscal year 1959 for the Federal Civil Defense Administration at Long Beach Inlet, Brunswick County, N.C.; and for the Department of the Navy at Pensacola Bay, Fla.

Construction operations were conducted during the year for the U.S. National Science Foundation by the Corps of Engineers, Huntington District; for the U.S. Department of State at Passamaquoddy, Maine; for the U.S. Fish and Wildlife Service at Crab Orchard Wildlife Refuge, Mo.; for the Bureau of Indian Affairs at various locations throughout the United States; and for the Department of the Navy at White Sands Point, N.Y.

Design, construction, and inspection of marine equipment was accomplished for the International Cooperation Administration; for the U.S. Air Force; for the St. Lawrence Seaway Corporation; for the Transportation Corps; for the Ordnance Corps; and for the military activities of the Corps of Engineers.

10. FOREIGN TECHNICAL ASSISTANCE

The Corps of Engineers continued to participate in the foreign technical assistance program of the Department of State and the International Cooperation Administration. This participation has entailed the detail of technical specialists abroad, the inservice training of selected engineers from foreign governments, the accommodation of visiting foreign nationals at civil works projects and activities, and the provision of engineering information and literature relating to the development of water resources.

Technical assistance was rendered to the Port Authority of Thailand in a preliminary study of the shoaling problem in Bangkok Harbor.

Training in flood control and harbor and power engineering was provided for selected engineers from the governments of Ceylon, Egypt, China (Taiwan), Greece, India, Japan, Pakistan, Philippines, Turkey, and Vietnam.

The hopper dredge *Essayons* was loaned to the Suez Canal Authority for 6 months dredging in the Port Said Roadstead and in the Great Bitter Lake section of the Suez Canal. The dredge started operations on March 23, 1959, and has an outstanding record of having dredged and hauled 5,814,840 cubic yards of material through June 30, 1959. The dredge is expected to remove approximately 9 million cubic yards and is expected to return to New York the latter part of September.

In addition, the Corps of Engineers received foreign government representatives and engineers from various free nations and afforded them the opportunity to visit the Corps' civil works offices and projects to observe construction organizations and techniques.

Upon request, engineering information pertaining to the Corps' civil works program was furnished to foreign engineers and government representatives.

11. PUBLICATIONS OF THE CORPS OF ENGINEERS

The following publications pertaining to civil works activities were issued during the fiscal year 1959:

A. Available at the Government Printing Office, Washington 25, D.C., at indicated price.

1. Port Series:

No. 17, The Port of Tampa, Fla.....	\$1. 25
No. 19, Volume 1—Ports on the Gulf Coast of the United States: Port St. Joe, Panama City, and Pensacola, Fla.; Pascagoula and Gulfport, Miss.; and Baton Rouge and Lake Charles, La.....	2. 75

2. Transportation Series:

No. 3, Transportation Lines on the Great Lakes System, 1959...	. 60
No. 4, Transportation Lines on the Mississippi River System and the Gulf Intracoastal Waterway, 1958.....	1. 75
No. 5, Transportation Lines on the Atlantic, Gulf, and Pacific Coasts, 1958.....	2. 50

3. Engineer Manuals:

EM 1110-2-1903, Bearing Capacity of Soils.....	. 35
EM 1110-2-2200, Gravity Dam Design.....	. 20
EM 1110-2-2300, Earth Embankments.....	1. 25
EM 1110-2-2601, Navigation Locks.....	. 75
EM 1110-2-2607, Navigation Dam Masonry.....	. 20

3. Engineer Manuals—Continued

EM 1110-2-3600, Reservoir Regulation.....	\$0.65
EM 1110-2-4300, Instrumentation for Measurement of Structural Behavior of Concrete Gravity Structures.....	.75

B. Available at place of publication at listed price or as indicated.

1. Great Lakes Pilot, 1959. U.S. Army Engineer District, Lake Survey, Detroit 26, Mich. (including supplements)..... 3.25
2. 1959 Supplement to List of Publications of the Waterways Experiment Station, Jan. 1, 1958. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.-----Gratis
3. Waterborne Commerce of the United States, calendar year 1958:
 - Part 1, Waterways and Harbors: Atlantic Coast. U.S. Army Engineer Division, New England, Waltham, Mass., or U.S. Army Engineer District, Lake Survey, Detroit 26, Mich.----- 1.30
 - Part 2, Waterways and Harbors: Gulf Coast, Mississippi River System and Antilles. U.S. Army Engineer Division, Lower Mississippi Valley, Vicksburg, Miss., or U.S. Army Engineer District, Lake Survey, Detroit 26, Mich.----- 1.20
 - Part 3, Waterways and Harbors: Great Lakes. U.S. Army Engineer District, Lake Survey, Detroit 26, Mich.--- .80
 - Part 4, Waterways and Harbors: Pacific Coast, Alaska, and Pacific Islands. U.S. Army Engineer District, San Francisco, San Francisco 19, Calif., or U.S. Army Engineer District, Lake Survey, Detroit 26, Mich.--- .95
 - Part 5, National Summaries: U.S. Army Engineer District, Lake Survey, Detroit 26, Mich.----- .35

Division addresses:

- U.S. Army Engineer Division, Lower Mississippi Valley, Post Office Box 80, Vicksburg, Miss.
- U.S. Army Engineer Division, Missouri River, Post Office Box 1216, Omaha, Nebr.
- U.S. Army Engineer Division, New England, 424 Trapelo Road, Waltham 54, Mass.
- U.S. Army Engineer Division, North Atlantic, 1216 Federal Office Building, 90 Church Street, New York 7, N.Y.
- U.S. Army Engineer Division, North Central, 536 South Clark Street, Chicago 5, Ill.
- U.S. Army Engineer Division, North Pacific, 210 Custom House, Portland 9, Oreg.
- U.S. Army Engineer Division, Ohio River, Post Office Box 1159, Cincinnati, Ohio.
- U.S. Army Engineer Division, Pacific Ocean, Building 96, Fort Armstrong, Honolulu 13, Hawaii.
- U.S. Army Engineer Division, South Atlantic, Post Office Box 1889, Atlanta, Ga.
- U.S. Army Engineer Division, South Pacific, Post Office Box 3339, Rincon Annex, San Francisco 19, Calif.
- U.S. Army Engineer Division, Southwestern, Santa Fe Building, 1114 Commerce Street, Dallas 2, Tex.

CHAPTER VII

ECONOMY MEASURES

ORGANIZATION, FACILITIES AND PROCEDURES

Effective steps were taken during the year to increase efficiency and economy in the supervision and administration of the civil works program as well as in operational performance through improved organizations and procedures and by changes in working methods. Sound business management efforts have been intensified to provide an offsetting factor against higher price levels and increasingly complex water resource problems. Significant economies have been realized.

Organization. Sustained and increased workloads, both civil and military, require retention of all existing division and district organizations for the civil works program. In the New England Division the Army's surplus Murphy General Hospital was transferred to the Corps of Engineers and the New England Division was relocated to this installation.

Floating and other plant operations. Constant review is maintained to find ways of improving the efficiency and utilization of existing plant to replace obsolete units and make increased use of available commercial facilities. In connection therewith, the following changes relating to major items of plant have been effected:

Repowering, repairs, and alterations, including the installation of controlled pitch propellers on the hopper dredge *Chester Harding*, have been completed. The operating efficiency of the plant has been appreciably increased and the estimated useful life extended 10 years. The *Harding* is in operation on the west coast as a replacement for the dredge *Rossell*, which was rammed and sunk by the Norwegian freighter *Thorshall*. Losses incurred were recovered in the amount of \$900,000.

The construction of the hopper dredge *Markham*, the new dredge for the Great Lakes, is progressing on schedule. The dredge was launched on June 10, 1959, and completion and delivery are expected early in 1960.

Pipeline dredge *Campbell* was declared excess to Corps needs and transferred to the Department of the Interior for the Island Trust

Territories. Pipeline dredge *Chittenden* has been declared excess and negotiations were initiated through ICA for transfer to the China National Government in Formosa.

A study was made of the aircraft operated under Corps of Engineers authority in the Southwestern Division and the Missouri River Division. It was determined that the services provided by these two airplanes could now adequately be provided by available commercial services. One of these, on loan from the Air Force, has been returned and the other is in the process of being disposed of under current disposal regulations.

Studies and investigations are continuing in connection with improving the design and increasing the operating efficiency of dredge pumps, dragheads, and distribution systems and the testing and evaluation of commercially available radio waves which will permit accurate positioning of dredges and survey boats in fog or other inclement weather.

The following are examples of outstanding management improvements related to plant operations which are presently in effect and have been evaluated and reported this fiscal year:

Improvements made as a result of materials studies in connection with the operation of the articulated concrete mattress plants on the lower Mississippi River resulted in substantial annual saving to civil works appropriations during the fiscal year 1959. In the construction of concrete mattresses, two thicknesses of 50-pound kraft paper, purchased under contract, were used between each layer. This material, under contract, cost \$0.42 per square of concrete mattress. It was determined that excess Quartermaster barrier paper was available at a cost of \$0.15 per square of concrete mattress. The use of this obsolete material in the construction of 490,000 squares of concrete mattress at a net saving of \$0.27 per square resulted in an annual saving of \$122,300.

The New Orleans District has the assignment of procuring and stocking spare parts for the *Comber*-class dredges. Due to procurement difficulties encountered, the adjustable dragheads used on these dredges were redesigned, substituting steel castings in lieu of the abrasive-resisting steel plates which were formerly used to form the fore and after bodies. Dragheads purchased under the new design are providing comparable service and have resulted in a saving of \$12,550, or 50 percent per unit.

Project operations. Improved methods and procedures have resulted in significant savings in project operations. For instance, the Walla Walla District introduced a new design for temporary fish passage facilities during construction of the Ice Harbor Lock and

Dam on the Snake River, Wash., by utilizing buckets and a cableway to transport fish, in lieu of the conventional temporary fish ladder. Estimated savings are over \$1 million. Another example is the adoption of improved spraying equipment or systems which has effected about \$22,000 savings in larviciding malaria-carrying, mosquito-breeding areas in the Cheatham Reservoir, Nashville District.

Supply. Improvements achieved in civil supply operations resulted in economies of approximately \$1 million, of which approximately \$750,000 represented savings in utilization of excess personal property acquired from other agencies in lieu of resorting to new procurement from commercial sources. The remaining actions represented improvements in a variety of supply administrative processes. Typical of these actions was an interservice agreement arranged by the Detroit District with the Department of the Navy for providing civil works with marine-type equipment and spare parts from available Navy stocks on a reimbursement basis. This service has been made available to other districts that operate major items of floating plant. Total economies realized by districts under the North Central Division during fiscal year 1959 afforded by this service amounted to approximately \$205,000.

CHAPTER VIII

WATERBORNE COMMERCE OF THE UNITED STATES

The waterborne commerce of the United States totaled 1,004.5 million tons during calendar year 1958, a decline of 11.2 percent from the previous year. However, 1958 was the fourth successive year in which more than a billion tons were transported by water.

Principal losses occurred in exports to foreign countries, 30.7 percent below 1957, and in the domestic Great Lakes trade which was 27.4 percent lower than last year. Imports from foreign countries showed a modest gain of 1.7 percent with a 1958 total of 189.5 million tons and maintained an uninterrupted climb since the close of World War II. Other domestic trades registered decreases in varying degrees from 1.2 percent for the coastwise trades to 7.1 percent for internal traffic, with the exception of intraterritory traffic, which at 2.8 million tons was 17.8 percent ahead of 1957. Total domestic traffic amounted to 695.7 million tons in 1958 as compared with the 1957 total of 772.9 million tons; total foreign traffic was 308.9 million tons and 358.5 million tons for 1958 and 1957, respectively.

Ton-miles, which reached a record high of 231.8 billion in 1957, fell off in 1958 to 189.0 billion, a decrease of 18.5 percent, which was greater than the loss in tonnage and reflected the greater relative decline in the long-haul traffic on the Great Lakes. The Mississippi River System accounted for 59.2 billion ton-miles of the 1958 total, which was only 1.5 billion ton-miles, or 2.5 percent less than in 1957; the Great Lakes System had 79.9 billion ton-miles in 1958 and 117.2 billion ton-miles in 1957; and the coastal waterway's 53.8 billion ton-miles in 1957 dropped to 49.9 billion ton-miles in 1958.

Total freight handled at ports and carried on the waterways improved by the Corps of Engineers under Congressional authorization are presented in the following tabulations. Detailed data on the commodities handled, the vessel trips at the ports, and the individual waterways are contained in the publications listed below, which may be purchased from the sales agent of the Superintendent of Documents, U.S. Army Engineer District, Lake Survey, 630 Federal Building, Detroit 26, Mich.

Waterborne Commerce of the United States, Calendar Year 1958:

Part 1, Atlantic Coast.

Part 2, Gulf Coast, Mississippi River System, and Antilles.

Part 3, Great Lakes.

Part 4, Pacific Coast, Alaska, and Pacific Islands.

Part 5, National Summaries.

The terms applied to the kinds of traffic are explained in each of these regional publications.

Authorization for the collection of these data is contained in various river-and-harbor acts enacted by Congress through the years, the principal authorization being section 11 of the River and Harbor Act of September 22, 1922. While the information as now collected and compiled is designed to meet the administrative requirements of the Corps of Engineers in connection with the prosecution of the navigation program as required by Congress, it also provides necessary and vital data for other governmental departments, commercial and shipping concerns, and others interested in transportation.

TOTAL WATERBORNE COMMERCE OF THE UNITED STATES 1949-1958

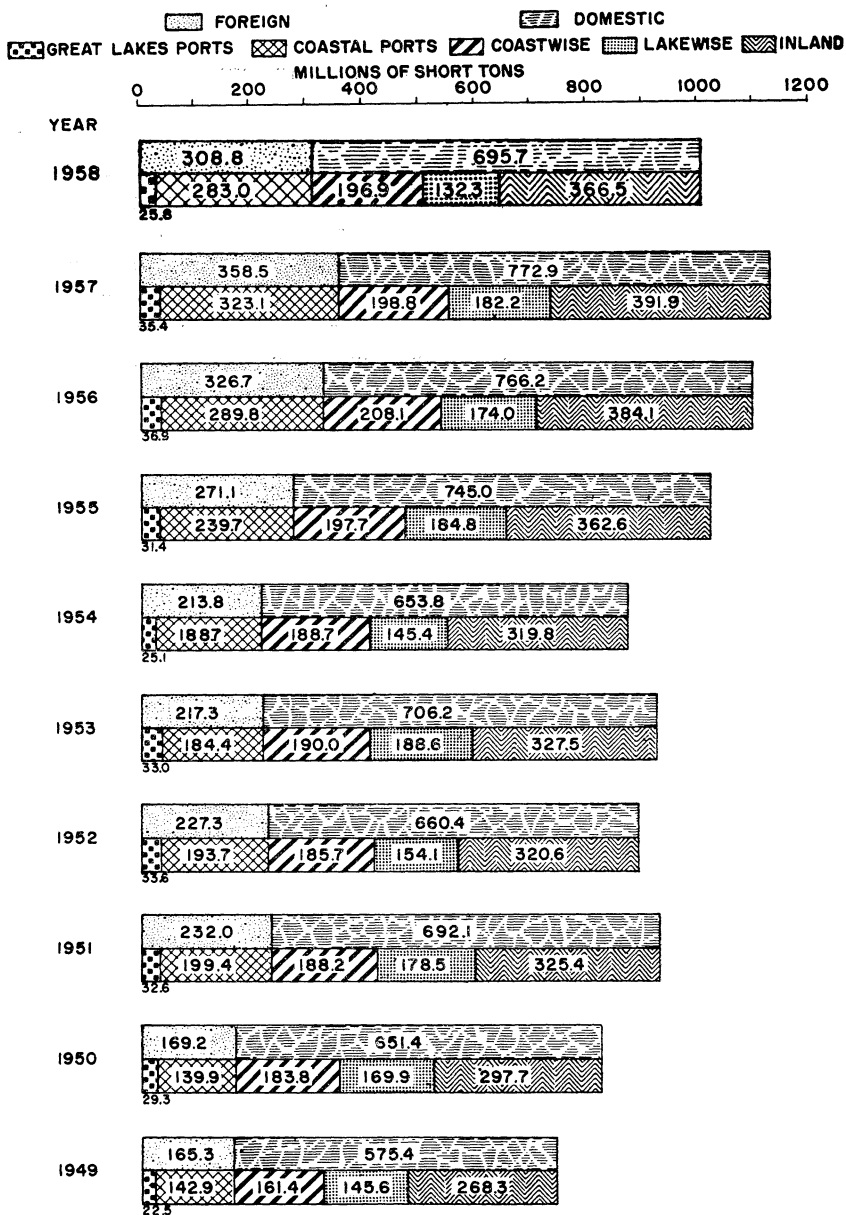


Chart VII

Table 24. Total Waterborne Commerce of the United States, Calendar Years 1948-58

[In millions of tons of 2,000 pounds]

Year	Foreign							Domestic						
	Total	Imports			Exports			Total	Coastwise	Lakewise	Internal	Intraport	Local	Intrater- ritory
		Total	Coastal ports	Great Lakes ports	Total	Coastal ports	Great Lakes ports							
1948-----	793. 2	72. 3	68. 1	4. 2	90. 7	65. 4	25. 3	630. 2	174. 1	172. 5	169. 7	58. 9	55. 0	(*)
1949-----	740. 7	82. 0	77. 2	4. 8	83. 4	65. 7	17. 6	575. 4	161. 4	145. 6	165. 7	48. 3	54. 3	(*)
1950-----	820. 6	102. 0	96. 3	5. 7	67. 2	43. 6	23. 6	651. 4	182. 5	169. 9	190. 8	51. 7	55. 2	1. 2
1951-----	924. 1	108. 7	101. 8	6. 9	123. 3	97. 6	25. 7	692. 1	186. 8	178. 5	213. 4	51. 0	61. 1	1. 4
1952-----	887. 7	116. 0	108. 7	7. 3	111. 4	85. 1	26. 3	660. 4	184. 2	154. 1	216. 6	49. 2	54. 8	1. 5
1953-----	923. 5	128. 0	120. 6	7. 4	89. 4	63. 8	25. 6	706. 2	188. 8	188. 6	225. 0	47. 9	54. 7	1. 3
1954-----	867. 6	129. 4	123. 5	5. 9	84. 4	65. 2	19. 2	653. 8	187. 2	145. 4	217. 1	48. 0	54. 7	1. 4
1955-----	1, 016. 1	153. 0	144. 3	8. 7	118. 1	95. 4	22. 7	745. 0	195. 7	184. 8	249. 7	52. 9	60. 0	2. 0
1956-----	1, 092. 9	174. 2	163. 3	10. 9	152. 5	126. 5	26. 0	766. 2	205. 9	174. 0	269. 7	53. 1	61. 3	2. 2
1957-----	1, 131. 4	186. 4	176. 2	10. 1	172. 2	146. 9	25. 3	772. 9	196. 4	182. 2	281. 1	50. 2	60. 6	2. 4
1958-----	1, 004. 5	189. 5	181. 5	8. 0	119. 4	101. 6	17. 8	695. 7	194. 1	132. 3	261. 1	48. 9	56. 5	2. 8

*Included in other types of domestic traffic.

Note. Totals represent the sums of unrounded figures, hence they may vary slightly from the sums of the rounded amounts.

Table 25. Commerce at Project Harbors, Calendar Year 1958
[In tons of 2,000 pounds]

Harbor	Tons
<i>Other Than Great Lakes</i>	
Bar Harbor, Maine.....	1, 644
Belfast Harbor, Maine.....	6, 767
Boothbay Harbor, Maine.....	1, 638
Camden Harbor, Maine.....	100
Cape Porpoise Harbor, Maine.....	3, 104
Corea Harbor, Maine.....	648
Hendricks Harbor, Maine*.....	-----
Isle au Haut Thoroughfare, Maine.....	1, 990
New Harbor, Maine.....	1, 048
Northeast Harbor, Maine.....	460
Portland Harbor, Maine.....	15, 590, 854
Rockland Harbor, Maine.....	110, 560
Rockport Harbor, Maine.....	66
Stonington Harbor, Maine.....	15, 289
Thomaston Harbor, Maine*.....	-----
Wood Island Harbor, Maine, and the Pool at Biddeford.....	128
York Harbor, Maine.....	484
Burlington Harbor, Vt.....	443, 551
Portsmouth Harbor, N.H.....	1, 219, 120
Beverly Harbor, Mass.....	177, 193
Boston, Main Waterfront, Mass.....	5, 857, 863
Cohasset Harbor, Mass.....	216
Cuttyhunk Harbor, Mass.....	576
Duxbury Harbor, Mass.....	22
Edgartown Harbor, Mass.*.....	-----
Fall River Harbor, Mass.....	2, 101, 916
Gloucester Harbor, Mass.....	183, 977
Harbor of Refuge, Nantucket, Mass.....	36, 148
Hingham Harbor, Mass.*.....	-----
Lynn Harbor, Mass.....	14, 511
Manchester Harbor, Mass.....	225
Marblehead Harbor, Mass.*.....	-----
New Bedford and Fairhaven Harbors, Mass.....	219, 643
Newburyport Harbor, Mass.*.....	-----
Plymouth Harbor, Mass.....	13, 091
Pollock Rip Shoals, Nantucket Sound, Mass.*.....	-----
Port of Boston, Mass.....	19, 275, 022
Provincetown Harbor, Mass.....	14, 216
Rockport Harbor, Mass.....	313
Salem Harbor, Mass.....	1, 377, 014
Scituate Harbor, Mass.....	105
Vineyard Haven Harbor, Mass.....	50, 798
Wellfleet Harbor, Mass.*.....	-----
Great Salt Pond, Block Island, R.I.....	915
Harbor of Refuge, Block Island, R.I.....	944

*No commerce reported.

Table 25. Commerce at Project Harbors, Calendar Year 1958—Continued
[In tons of 2,000 pounds]

Harbor	Tons
<i>Other Than Great Lakes—Continued</i>	
Harbor of Refuge, Point Judith and Point Judith Pond, R.I.-----	50, 843
Newport Harbor, R.I.-----	112, 877
Providence River and Harbor, R.I.-----	7, 889, 434
Wickford Harbor, R.I.*-----	-----
Branford Harbor, Conn.*-----	-----
Bridgeport Harbor, Conn.-----	2, 296, 851
Clinton Harbor, Conn.-----	14
Duck Island Harbor, Conn.*-----	-----
Fivemile River Harbor, Conn.-----	340
Greenwich Harbor, Conn.-----	76, 239
Milford Harbor, Conn.-----	3, 188
New Haven Harbor, Conn.-----	7, 224, 793
New London Harbor, Conn.-----	1, 055, 991
Norwalk Harbor, Conn.-----	317, 039
Southport Harbor, Conn.*-----	-----
Stamford Harbor, Conn.-----	709, 353
Stonington Harbor, Conn.-----	3, 080
Westport Harbor and Saugatuck River, Conn.-----	13, 248
Echo Bay Harbor, N.Y.-----	91, 673
Great Kills Harbor, Staten Island, N.Y.*-----	-----
Greenport Harbor, N.Y.-----	27, 191
Hay (West) Harbor, N.Y.*-----	-----
Hempstead Harbor, N.Y.-----	5, 396, 260
Huntington Harbor, N.Y.-----	403, 835
Lake Montauk Harbor, N.Y.-----	2, 223
Mamaroneck Harbor, N.Y.-----	155, 227
Mattituck Harbor, N.Y.-----	55, 588
New Rochelle Harbor, N.Y.-----	590
Northport Harbor, N.Y.-----	27, 271
Peekskill Harbor, N.Y.-----	169, 124
Plattsburg Harbor, N.Y.-----	499, 262
Port Chester Harbor, N.Y.-----	778, 709
Port Henry Harbor, N.Y.-----	6, 772
Port Jefferson Harbor, N.Y.-----	1, 154, 691
Port of New York, N.Y., and N.J.-----	145, 531, 300
Rondout Harbor, N.Y.-----	904, 229
Sag Harbor, N.Y.-----	24, 549
Saugerties Harbor, N.Y.*-----	-----
Tarrytown Harbor, N.Y.-----	541, 028
Camden-Gloucester, N.J.-----	3, 276, 491
Keyport Harbor, N.J.*-----	-----
Paulsboro, N.J., and vicinity-----	13, 887, 393
Trenton Harbor, N.J.-----	393, 036
Aliquippa-Rochester, Pa.-----	6, 450, 184
Chester, Pa.-----	971, 355

*No commerce reported.

Table 25. Commerce at Project Harbors, Calendar Year 1958—Continued
[In tons of 2,000 pounds]

Harbor	Tons
<i>Other Than Great Lakes—Continued</i>	
Clairton-Elizabeth, Pa.....	8, 542, 713
Marcus Hook, Pa., and vicinity.....	18, 185, 329
Penn Manor, Pa., and vicinity.....	6, 826, 767
Philadelphia Harbor, Pa.....	46, 663, 736
Pittsburgh, Pa.....	7, 635, 702
New Castle, Del., and vicinity.....	10, 536, 670
Wilmington Harbor, Del.....	2, 911, 721
Annapolis Harbor, Md.....	30, 286
Baltimore Harbor and Channels, Md.....	41, 703, 370
Black Walnut Harbor, Md.....	215
Breton Bay, Md.....	5, 108
Cambridge Harbor, Md.....	96, 113
Claiborne Harbor, Md.....	139
Crisfield Harbor, Md.....	50, 809
Lowes Wharf, Talbot County, Md.....	4, 239
Nanticoke River at Bivalve, Md.....	2, 570
Nanticoke River at Nanticoke, Md.....	3, 473
Ocean City Harbor and Inlet and Sinepuxent Bay, Md.....	3, 147
Queenstown Harbor, Md.....	187
Rock Hall Harbor, Md.....	7, 042
Tilghman Island Harbor, Md.....	1, 228
Washington Harbor, D.C.....	1, 957, 050
Cape Charles City Harbor, Va.....	2, 828
Horn Harbor, Va.....	12, 601
Monroe Bay and Creek, Va.....	2, 353
Norfolk Harbor, Va.....	38, 662, 972
Port of Newport News, Va.....	20, 922, 058
Portsmouth Harbor, Va., Channel to Nansemond Ordnance Depot*.....	
Port of Richmond, Va.....	2, 652, 921
Potomac River at Alexandria, Va.....	333, 857
Winter Harbor, Va.....	9, 160
Beaufort Harbor, N.C.....	88, 740
Belhaven Harbor, N.C.....	13, 004
Edenton Harbor, N.C.....	30, 572
Manteo (Shallowbag) Bay, N.C.....	70, 664
Morehead City Harbor, N.C.....	506, 616
Port of Wilmington, N.C.....	3, 859, 411
Silver Lake Harbor, N.C.....	3, 587
Charleston Harbor, S.C.....	4, 358, 853
Georgetown Harbor (Winyah Bay), S.C.....	989, 313
Brunswick Harbor, Ga.....	404, 821
Darien Harbor, Ga.....	1, 789
Savannah Harbor, Ga.....	4, 086, 901
Apalachicola Bay, Fla.....	14, 275
Bayou Chico, Fla.....	82, 659

*No commerce reported.

Table 25. Commerce at Project Harbors, Calendar Year 1958—Continued
[In tons of 2,000 pounds]

Harbor	Tons
<i>Other Than Great Lakes—Continued</i>	
Canaveral Harbor, Fla.....	235, 655
Carrabelle Harbor, Fla.....	16, 603
Cedar Keys Harbor, Fla.....	3, 355
Charlotte Harbor, Fla.....	870, 810
Eau Gallie Harbor, Fla.*	-----
Fernandina Harbor, Fla.....	148, 884
Fort Pierce Harbor, Fla.....	110, 205
Jacksonville Harbor, Fla.....	7, 736, 879
Key West Harbor, Fla.....	186, 286
Melbourne Harbor, Fla.....	45
Miami Harbor, Fla.....	1, 809, 167
Palm Beach Harbor, Fla.....	907, 457
Panama City Harbor, Fla.....	1, 082, 818
Pensacola Harbor, Fla.....	682, 501
Port Everglades Harbor, Fla.....	6, 465, 413
Port St. Joe Harbor, Fla.....	1, 543, 947
St. Augustine Harbor, Fla.....	7, 611
St. Petersburg Harbor, Fla.....	308, 561
Tampa Harbor, Fla.....	12, 989, 979
Chickasaw Creek, Ala.....	662, 103
Guntersville, Ala.....	977, 842
Mobile Harbor, Ala.....	18, 474, 740
Three Mile Creek, Ala.....	3, 438, 304
Baton Rouge, La.....	20, 923, 180
Lake Charles, La. (Calcasieu River and Pass, La.).....	15, 380, 324
New Orleans, La.....	51, 711, 671
Terrebonne Bay, La.*	-----
Biloxi Harbor, Miss.....	207, 424
Greenville, Miss.....	1, 390, 983
Gulfport Harbor, Miss.....	214, 154
Natchez, Miss.....	440, 920
Pascagoula Harbor, Miss.....	412, 749
Pass Christian Harbor, Miss.....	3, 128
Vicksburg, Miss.....	788, 785
Aransas Pass, Tex.....	79, 765
Beaumont, Tex.....	24, 529, 907
Brazos Island Harbor, Tex.....	1, 402, 110
Corpus Christi, Tex.....	16, 460, 662
Freeport Harbor, Tex.....	4, 018, 183
Galveston, Tex. (Galveston Channel, Tex.).....	6, 266, 470
Harbor Island, Tex.....	5, 328, 386
Houston, Tex. (Houston Ship Channel, Tex.).....	55, 258, 046
Orange, Tex.....	1, 358, 697
Palacios, Tex.....	92, 272
Port Arthur, Tex.....	23, 530, 210

*No commerce reported.

Table 25. Commerce at Project Harbors, Calendar Year 1958—Continued
 [In tons of 2,000 pounds]

Harbor	Tons
<i>Other Than Great Lakes—Continued</i>	
Port Bolivar, Tex.....	5, 747
Port Lavaca, Tex.....	690, 257
Port Mansfield, Tex.....	15, 196
Rockport, Tex.....	2, 598
Sabine Pass Harbor, Tex.....	20, 711
Texas City, Tex. (Texas City Channel, Tex.).....	14, 060, 214
Victoria, Tex.....	180, 457
Helena, Ark.....	2, 064, 848
Chattanooga, Tenn.....	1, 507, 724
Knoxville, Tenn.....	745, 236
Memphis, Tenn.....	5, 312, 618
Nashville, Tenn.....	2, 361, 719
Kansas City, Mo.....	865, 431
St. Louis, Mo.....	7, 198, 627
Cincinnati, Ohio.....	7, 497, 960
Louisville, Ky.....	5, 099, 625
Huntington, W. Va.....	12, 802, 283
Baudette Harbor, Minn.*.....	—
Minneapolis, Minn.....	762, 136
St. Paul, Minn.....	3, 088, 649
Warroad Harbor, Minn.....	1, 460
Mount Vernon, Ind.....	4, 699, 217
Bodega Bay, Calif.....	2, 050
Crescent City Harbor, Calif.....	466, 456
Humboldt Harbor and Bay, Calif.....	782, 764
Long Beach Harbor, Calif.....	7, 404, 958
Los Angeles Harbor, Calif.....	17, 342, 260
Monterey Harbor, Calif.....	110, 906
Morro Bay Harbor, Calif.....	17, 794
Moss Landing Harbor, Calif.....	142, 388
Newport Bay Harbor, Calif.....	2, 918
Oakland Harbor, Calif.....	3, 772, 415
Redondo Beach (King Harbor), Calif.....	70
Redwood City Harbor, Calif.....	3, 064, 645
Richmond Harbor, Calif.....	15, 359, 652
San Diego Harbor, Calif.....	1, 737, 761
San Francisco Harbor, Calif.....	4, 091, 120
Santa Barbara Harbor, Calif.....	2, 461
Stockton, Calif.....	3, 132, 099
Astoria, Oreg.....	408, 963
Coos Bay, Oreg.....	3, 820, 576
Depoe Bay, Oreg.....	314
Oregon Slough (North Portland Harbor), Oreg.....	368, 318
Portland, Oreg.....	11, 605, 479

*No commerce reported.

Table 25. Commerce at Project Harbors, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Harbor	Tons
<i>Other Than Great Lakes—Continued</i>	
St. Helens, Oreg.....	484, 323
Tillamook Bay and Bar, Oreg.....	31, 560
Yaquina Bay and Harbor, Oreg.....	487, 439
Anacortes Harbor, Wash.....	4, 601, 767
Bellingham Bay and Harbor, Wash.....	1, 367, 446
Blaine Harbor, Wash.....	13, 940
Everett Harbor, Wash.....	2, 822, 808
Grays Harbor and Chehalis River, Wash.....	1, 712, 639
Hammersley Inlet, Wash.....	837, 240
Longview, Wash.....	2, 363, 629
Neah Bay, Wash.....	171, 263
Olympia Harbor, Wash.....	1, 300, 117
Port Angeles Harbor, Wash.....	1, 647, 284
Port Gamble Harbor, Wash.....	215, 321
Seattle Harbor, Wash.....	11, 856, 004
Tacoma Harbor, Wash.....	3, 989, 062
Vancouver, Wash.....	1, 742, 785
Willapa River and Harbor, and Naselle River, Wash.....	396, 396
Arecibo Harbor, P.R.....	100
Fajardo Harbor, P.R.....	157, 018
Guayanes Harbor, P.R.....	18, 486
Mayaguez Harbor, P.R.....	275, 406
Ponce Harbor, P.R.....	735, 606
San Juan Harbor, P.R.....	3, 964, 866
Christiansted Harbor, St. Croix, V.I.....	30, 087
St. Thomas Harbor, V.I.....	589, 723
Hilo Harbor, Hawaii.....	647, 874
Honolulu Harbor, Hawaii.....	4, 125, 721
Kahului Harbor, Maui, Hawaii.....	536, 585
Kaunakakai Harbor, Molokai, Hawaii.....	269, 509
Kawaihae Harbor, Hawaii.....	37, 172
Nawiliwili Harbor, Kauai, Hawaii.....	301, 018
Port Allen Harbor, Hawaii.....	127, 405
Wake Island Harbor.....	119, 233
Cordova Harbor, Alaska.....	44, 952
Craig Harbor, Alaska.....	1, 384
Elfin Cove, Alaska.....	9, 139
Iliuliuk Harbor, Alaska.....	119, 676
Juneau Harbor, Alaska.....	166, 451
Ketchikan Harbor, Alaska.....	700, 262
Kodiak Harbor, Alaska.....	38, 656
Metlakatla Harbor, Alaska.....	9, 097
Myers Chuck Harbor, Alaska*	
Nome, Alaska.....	54, 870
Petersburg Harbor, Alaska.....	27, 203
Port Alexander, Alaska.....	80

*No commerce reported.

Table 25. Commerce at Project Harbors, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Harbor	Tons
<i>Other Than Great Lakes—Continued</i>	
Seldovia Harbor, Alaska.....	12, 629
Seward Harbor, Alaska.....	450, 705
Sitka Harbor, Alaska.....	105, 419
Skagway Harbor, Alaska.....	53, 108
Valdez Harbor, Alaska.....	57, 361
Whittier Harbor, Alaska.....	129, 969
Wrangell Harbor, Alaska.....	83, 396
<i>Great Lakes</i>	
Beaver Bay Harbor, Minn.....	43
Duluth-Superior Harbor, Minn. and Wis.....	34, 487, 620
Grand Marais Harbor, Minn.....	78, 465
Knife River Harbor, Minn.....	145
Lutsen Harbor, Minn.....	5
Two Harbors (Agate Bay), Minn.....	11, 661, 195
Warroad, Minn.....	1, 460
Zippel Bay, Minn.*.....	-----
Algoma Harbor, Wis.....	161
Ashland Harbor, Wis.....	2, 862, 722
Bayfield Harbor, Wis.....	3, 525
Cornucopia, Wis.....	344
Detroit Harbor, Wis.....	9, 279
Green Bay Harbor, Wis.....	3, 460, 832
Jackson Harbor, Wis.....	174
Kenosha Harbor, Wis.....	48, 825
Kewaunee Harbor, Wis.....	1, 102, 023
Manitowoc Harbor, Wis.....	2, 083, 281
Milwaukee Harbor, Wis.....	7, 658, 689
Oconto Harbor, Wis.....	63
Pensaukee Harbor, Wis.....	177
Port Washington Harbor, Wis.....	837, 838
Port Wing Harbor, Wis.....	209
Racine Harbor, Wis.....	123, 521
Sheboygan Harbor, Wis.....	513, 654
Two Rivers Harbor, Wis.....	162, 909
Algonac, Mich.....	13, 283
Alpena Harbor, Mich.....	2, 205, 060
Big Bay Harbor, Mich.....	5
Black River Harbor, Mich.....	48
Charlevoix Harbor, Mich.....	77, 567
Cheboygan Harbor, Mich.....	74, 513
Detour, Mich.....	266, 693
Drummond Island, Mich.....	1, 767, 146
Frankfort Harbor, Mich.....	1, 496, 760

*No commerce reported.

Table 25. Commerce at Project Harbors, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Harbor	Tons
<i>Great Lakes—Continued</i>	
Gladstone Harbor, Mich.....	216, 944
Grand Haven Harbor and Grand River, Mich.....	2, 869, 265
Grand Marais, Mich.....	70
Grand Traverse Bay Harbor, Mich.....	545
Harbor Beach, Mich., Harbor of Refuge.....	45, 860
Holland Harbor, Mich.....	203, 538
Isle Royale, Mich.*.....	-----
Lac La Belle Harbor, Mich.....	18
Leland Harbor, Mich.....	348
Lime Island, Mich.....	204, 154
Ludington Harbor, Mich.....	3, 504, 549
Mackinac Harbor, Mich.....	8, 769
Manistee, Mich.....	430, 601
Manistique Harbor, Mich.....	221, 565
Marine City, Mich.....	108, 441
Marquette Harbor, Mich.....	771, 564
Marysville, Mich.....	166, 005
Menominee Harbor, Mich.....	682, 508
Monroe Harbor, Mich.....	25, 922
Muskegon Harbor, Mich.....	3, 483, 745
Ontonogan Harbor, Mich.....	61
Pentwater Harbor, Mich.....	53
Port Huron, Mich.....	771, 457
Port of Detroit, Mich.....	21, 822, 093
Port of Sault Ste. Marie, Mich.....	330, 764
Presque Isle Harbor, Mich.....	3, 176, 834
St. Clair, Mich.....	1, 572, 135
St. James Harbor (Beaver Island), Mich.....	1, 032
St. Joseph Harbor, Mich.....	289, 671
Saugatuck Harbor and Kalamazoo River, Mich.....	187
South Haven Harbor, Mich.....	77, 995
Traverse City Harbor, Mich.....	228, 719
Whitefish Point Harbor, Mich.....	202
White Lake Harbor, Mich.....	24, 701
Chicago Harbor, Ill.....	475, 845
Calumet Harbor and River, Ill. and Ind.....	19, 828, 936
Port of Chicago, Ill. and Ind.....	36, 614, 376
Waukegan Harbor, Ill.....	82, 466
Indiana Harbor, Ind.....	18, 068, 160
Michigan City Harbor, Ind.....	36, 099
Ashtabula Harbor, Ohio.....	8, 369, 615
Cleveland Harbor, Ohio.....	11, 825, 488
Conneaut Harbor, Ohio.....	6, 620, 802
Fairport Harbor, Ohio.....	2, 514, 630
Huron Harbor, Ohio.....	1, 750, 737

*No commerce reported.

Table 25. Commerce at Project Harbors, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Harbor	Tons
<i>Great Lakes—Continued</i>	
Lorain Harbor, Ohio.....	4, 711, 799
Port Clinton Harbor, Ohio.....	7, 460
Put In Bay, Ohio.....	6, 224
Sandusky Harbor, Ohio.....	6, 285, 005
Toledo Harbor, Ohio.....	28, 742, 085
Vermilion Harbor, Ohio.....	877
Erie Harbor, Pa.....	4, 659, 635
Barcelona, N.Y.....	57
Cape Vincent, N.Y.....	10
Dunkirk Harbor, N.Y.....	34, 986
Great Sodus Bay Harbor, N.Y.....	1, 275, 519
Niagara Falls, N.Y.....	26, 800
Ogdensburg Harbor, N.Y.....	476, 936
Oswego Harbor, N.Y.....	1, 868, 755
Port of Buffalo, N.Y.....	15, 571, 925
Rochester (Charlotte) Harbor, N.Y.....	272, 562
Sackets Harbor, N.Y.....	49, 395
Tonawanda Harbor, N.Y.....	505, 841
Waddington Harbor, N.Y.....	81, 406
Wilson Harbor, N.Y.....	3

Table 26. Commerce at Selected Areas, Calendar Year 1958

[In tons of 2,000 pounds]

Area	Tons
Delaware River and tributaries, Trenton, N.J., to the sea:	
Burlington-Florence-Roebling, N.J.....	1, 199, 920
Camden-Gloucester, N.J.....	3, 276, 491
Chester, Pa.....	971, 355
Marcus Hook, Pa., and vicinity.....	18, 185, 329
New Castle, Del., and vicinity.....	10, 536, 670
Paulsboro, N.J., and vicinity.....	13, 887, 393
Penn Manor, Pa., and vicinity.....	6, 826, 767
Philadelphia Harbor, Pa.....	46, 663, 736
Riverton-Delanco-Beverly, N.J.....	860, 085
Trenton Harbor, N.J.....	393, 036
Wilmington Harbor, Del.....	2, 911, 721
Other.....	972, 663
Gross total.....	106, 685, 166
Net total.....	96, 742, 472

Table 26. *Commerce at Selected Areas, Calendar Year 1958—Continued*
 [In tons of 2,000 pounds]

Area	Tons
Hampton Roads, Va.:	
Channel from Phoebus, Va., to Deepwater in Hampton Roads	1, 837
Hampton Creek, Va.	419, 732
Norfolk Harbor, Va.	38, 662, 972
Port of Newport News, Va.	20, 922, 058
Gross total	60, 006, 599
Net total	59, 495, 423
Corpus Christi Bay, Tex.:	
Corpus Christi, Tex.	16, 460, 662
Harbor Island, Tex.	5, 328, 386
Gross total	21, 789, 048
Net total	21, 744, 814
San Francisco Bay, Calif.:	
Carquinez Strait, Calif.	7, 314, 261
Oakland Harbor, Calif.	3, 772, 415
Redwood City Harbor, Calif.	3, 064, 645
Richmond Harbor, Calif.	15, 359, 652
San Francisco Harbor, Calif.	4, 091, 120
San Pablo Bay and Mare Island Strait, Calif.	2, 766, 182
Suisun Bay Channel, Calif.	3, 596, 039
Other	2, 702, 988
Gross total	42, 667, 302
Net total	34, 652, 706
Chicago, Ill. and Ind.:	
Buffington Harbor, Ind.	1, 638, 054
Calumet Harbor and River, Ill. and Ind.	19, 828, 936
Chicago Harbor, Ill.	475, 845
Gary Harbor, Ind.	9, 353, 242
Indiana Harbor, Ind.	18, 068, 160
Lake Calumet, Ill.	742, 523
Other	17, 435, 786
Gross total	67, 542, 546
Net total	64, 660, 869

Table 27. Ton-Mileage of Freight Carried on the Inland Waterways of the United States, by System, Calendar Year 1958

System	Ton-miles
Atlantic coast waterways-----	29, 188, 171, 000
Gulf coast waterways-----	15, 781, 982, 000
Pacific coast waterways-----	4, 951, 893, 000
Mississippi River System, including Ohio River and tributaries--	59, 207, 559, 000
Other waterways-----	1, 546, 000
Great Lakes system*-----	79, 885, 238, 000
Total-----	189, 016, 389, 000

*Does not include traffic between foreign ports.

TON-MILES OF FREIGHT CARRIED ON THE WATERWAYS OF THE UNITED STATES, 1949-1958

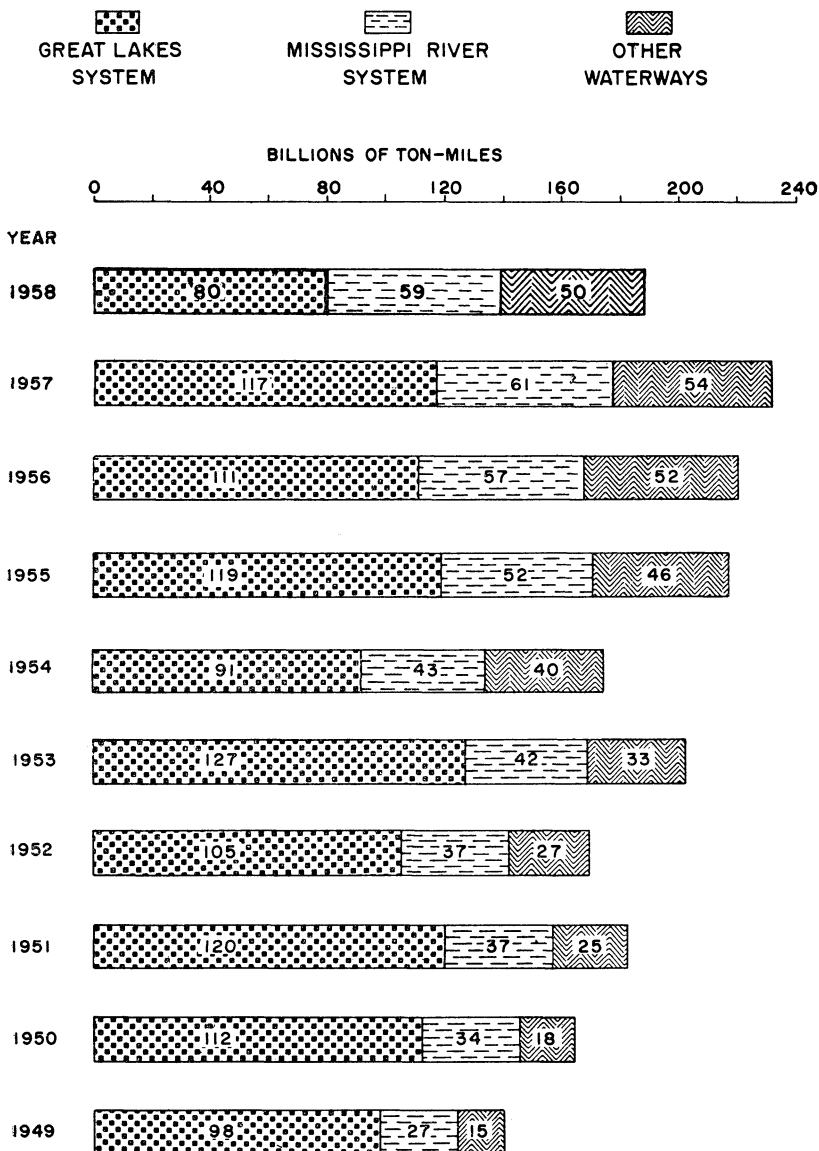


Chart VIII

Table 28. Commerce on Project Waterways, Calendar Year 1958

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
Josias River, Maine.....	84	(¹)
Kennebec River, Maine.....	107, 303	2, 308
Kennebunk River, Maine.....	17, 836	18
Lubec Channel, Maine.....	134, 039	233
Penobscot River, Maine.....	1, 091, 178	28, 098
Saco River, Maine.....	49	(¹)
St. Croix River, Maine.....	22, 045	373
Union River, Maine ²		
Otter Creek, Vt. ²		
Annisquam River, Mass. ²		
Cape Cod Canal, Mass.....	10, 672, 999	186, 777
Chelsea River, Mass.....	5, 390, 931	8, 086
Dorchester Bay, Mass.....	34, 971	35
Fort Point Channel, Mass.....	392, 117	196
Ipswich River, Mass.....	502	2
Malden River, Mass.....	47, 665	48
Merrimack River, Mass. ²		
Mystic River, Mass.....	5, 852, 071	5, 321
Neponset River, Mass. ²		
Taunton River, Mass. ³		
Town River, Mass.....	757, 118	568
Weymouth Back River, Mass.....	47, 607	24
Weymouth Fore River, Mass.....	2, 311, 355	13, 012
Woods Hole Channel, Mass.....	41, 516	37
Pawcatuck River, R.I. and Conn.....	4, 764	31
Sakonnet River and Harbor, R.I. ²		
Seekonk River, R.I.....	216, 230	432
Warren River, R.I. ²		
Connecticut River above Hartford, Conn. ²		
Connecticut River below Hartford, Conn.....	2, 742, 820	126, 170
Housatonic River, Conn.....	929, 819	4, 649
Mianus River and Cos Cob Harbor, Conn.....	45, 749	46
Mystic River, Conn.....	9	(¹)
Thames River, Conn.....	809, 094	12, 315
Bay Ridge and Red Hook Channels, N.Y.....	11, 928, 557	47, 714
Bronx River, N.Y.....	681, 768	1, 023
Browns Creek, N.Y.....	300	(¹)
Buttermilk Channel, N.Y.....	3, 838, 443	8, 828
Channel between Staten Island and Hoffman and Swinburne Islands, N.Y. ²		
Coney Island Channel, N.Y.....	5, 086, 464	6, 612
Coney Island Creek, N.Y.....	278, 101	279
East Chester Creek, N.Y.....	1, 779, 391	6, 228
East River, N.Y.....	49, 527, 486	396, 220
East Rockaway Inlet, N.Y.....	1, 256, 749	754

See footnotes at end of table.

Table 28. Commerce on Project Waterways, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
Fire Island Inlet, N.Y.-----	233, 443	350
Flushing Bay, N.Y.-----	2, 574, 581	8, 239
Glen Cove Creek, N.Y.-----	261, 148	261
Gowanus Creek Channel, N.Y.-----	4, 859, 427	3, 888
Great South Bay, N.Y.-----	255, 462	4, 323
Harlem River, N.Y.-----	2, 845, 172	11, 455
Hudson River, N.Y. and N.J.:		
Deep Water in Upper Bay, N.Y., to Water-		
ford, N.Y. (net)-----	40, 391, 046	1, 875, 404
Mouth of Spuyten Duyvil Creek (Harlem		
River) to Waterford, N.Y.-----	19, 147, 423	1, 505, 470
Hudson River Channel, N.Y. and N.J.-----	33, 811, 621	369, 934
Jamaica Bay, N.Y.-----	5, 192, 748	62, 313
Jones Inlet, N.Y.-----	6, 507	14
Lemon Creek, Staten Island, N.Y.-----	3, 569	2
Long Island Intracoastal Waterway, N.Y.-----	2, 048	70
Lower Entrance Channels, New York Harbor,		
N.Y.-----	90, 069, 621	900, 696
Manhasset Bay, N.Y.-----	1, 043, 281	1, 461
Narrows of Lake Champlain, N.Y. and Vt.-----	1, 092, 562	14, 750
New York and New Jersey Channels, N.Y. and		
N.J.-----	99, 605, 641	1, 858, 987
New York State Barge Canal System, N.Y.-----	4, 000, 580	554, 559
Newtown Creek, N.Y.-----	8, 681, 298	26, 044
Niagara River, N.Y.-----	3, 808, 251	(3)
Orowoc Creek, N.Y.-----	2, 606	2
Patchogue River, N.Y.-----	231, 603	174
Peconic Bay and River, N.Y.-----	2, 477	4
Sheepshead Bay, N.Y.-----	5, 469	3
Upper Bay, N.Y. and N.J.-----	106, 934, 680	590, 347
Wallabout Channel, N.Y.-----	277, 046	55
Wappinger Creek, N.Y. ² -----		
Westchester Creek, N.Y.-----	1, 082, 547	2, 165
Absecon Creek, N.J.-----	120	(1)
Absecon Inlet, N.J.-----	108, 580	217
Alloway Creek, N.J. ² -----		
Barnegat Inlet, N.J.-----	391	(1)
Big Timber Creek, N.J.-----	103, 472	31
Cape May Canal, N.J.-----	126	1
Cheesequake Creek, N.J. ² -----		
Cohansey River, N.J.-----	98, 698	1, 875
Cold Spring Inlet, N.J.-----	46, 641	47
Cooper River, N.J.-----	82, 100	82
Dennis Creek, N.J. ² -----		
Double Creek, N.J.-----	4	(1)

See footnotes at end of table.

Table 28. Commerce on Project Waterways, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
Elizabeth River, N.J.-----	6, 198	5
Goshen Creek, N.J. ² -----		
Hackensack River, N.J.-----	3, 875, 409	34, 879
Manasquan River, N.J.-----	37, 229	56
Mantua Creek, N.J.-----	296, 132	296
Matawan Creek, N.J. ² -----		
Maurice River, N.J.-----	15, 833	111
New Jersey Intracoastal Waterway-----	228, 870	1, 373
Newark Bay, N.J.-----	21, 117, 092	87, 239
Oldmans Creek, N.J. ² -----		
Passaic River, N.J.-----	10, 665, 521	79, 991
Raccoon Creek, N.J.-----	3, 780	34
Rahway River, N.J.-----	129, 926	299
Rancocas River, N.J.-----	664	1
Raritan River, N.J.-----	8, 310, 574	32, 992
Raritan River to Arthur Kill Cut-Off Channel, N.J.-----	4, 684, 221	4, 684
Salem River, N.J.-----	41, 389	166
Shark River, N.J.-----	375	2
Shoal Harbor and Compton Creek, N.J.-----	50, 978	13
Shrewsbury River, N.J.-----	70	(¹)
Toms River, N.J.-----	25	(¹)
Tuckerton Creek, N.J.-----	1, 476	4
Washington Canal and South River, N.J.-----	56, 083	191
Waycake Creek, N.J. ² -----		
Woodbridge Creek, N.J.-----	57, 345	8
Woodbury Creek, N.J. ² -----		
Chester River, Pa. ² -----		
Schuylkill River, Pa.-----	16, 300, 660	65, 203
Appoquinimink River, Del. ² -----		
Broad Creek, Del.-----	7, 344	73
Broadkill River, Del. ² -----		
Delaware River:		
Trenton, N.J., to the sea (net)-----	99, 844, 047	8, 339, 278
At Camden, N.J.-----	1, 492, 791	(⁴)
Between Philadelphia, Pa., and Trenton, N.J.-----	12, 808, 225	182, 533
Harbor of Refuge, Delaware Bay, Del.-----	174, 962	262
Philadelphia, Pa., to the sea-----	98, 274, 031	8, 156, 745
Indian River Inlet and Bay, Del.-----	2, 257	2
Inland Waterway between Rehoboth Bay and Delaware Bay, Del.-----	12, 785	141
Inland Waterway from Delaware River to Chesapeake Bay, Del. and Md.-----	9, 145, 768	420, 705
Leipsic River, Del. ² -----		
Little River, Del.-----	37	(¹)
Mispillion River, Del.-----	20, 352	244

See footnotes at end of table.

Table 28. *Commerce on Project Waterways, Calendar Year 1958—Continued*

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
Murderkill River, Del.....	1, 657	3
Nanticoke River (including Northwest Fork), Del. and Md.....	244, 313	9, 542
St. Jones River, Del.....	120	(1)
Smyrna River, Del. ²		
Back Creek (Anne Arundel County, Md.).....	723	(1)
Broad Creek, Somerset County, Md.....	3, 237	10
Broadwater Creek, Md.....	79	(1)
Cadle Creek, Md.....	2	(1)
Channel to Island Creek, St. George Island, Md.....	102	(1)
Chester River, Md.....	58, 371	1, 273
Chincoteague Bay, Md. and Va.....	28, 151	84
Choptank River, Md.....	126, 569	1, 767
Corsica River, Md.....	312	2
Duck Point Cove, Md.....	136	(1)
Elk and Little Elk Rivers, Md.....	16	(1)
Fishing Bay Tributaries, Dorchester County, Md.....	7, 194	7
Fishing Creek, Calvert County, Md.....	20	(1)
Governors Run, Md.....	715	(1)
Hellens Creek, Md.....	135	(1)
Herring Bay and Rockhold Creek, Md.....	39	(1)
Honga River and Tar Bay, Md.....	6, 147	25
Knapps Narrows, Md.....	1, 988	3
Lake Ogleton, Md. ²		
La Trappe River, Md.....	4, 921	17
Little Creek, Queen Annes County, Md.....	2, 627	1
Lower Thoroughfare at or near Wenona, Deal Island, Md.....	533	1
Manokin River, Md.....	70	(1)
Middle River and Dark Head Creek, Md.....	121	(1)
Mill Creek, Md.....	157	(1)
Neale Sound, Md.....	330	(1)
Northeast River, Md.....	507	3
Parish Creek, Md.....	1, 673	1
Patuxent River, Md.....	92, 885	717
Pocomoke River, Md.....	59, 198	1, 776
Rhodes Point to Tylerton, Somerset County, Md.....	99	(1)
St. Catherines Sound, Md.....	1, 910	3
St. Jerome Creek, Md.....	515	1
St. Patricks Creek, Md.....	1, 066	1
Slaughter Creek, Md.....	42	(1)
Smith Creek, Md.....	8, 052	12
Susquehanna River above and below Havre de Grace, Md.....	19, 628	98
Town Creek, Md.....	2, 779	1
Tred Avon River, Md.....	86, 486	865

See footnotes at end of table.

Table 28. Commerce on Project Waterways, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
Twitch Cove and Big Thoroughfare River, Md....	4, 105	21
Tyaskin Creek, Md.....	3	(1)
Upper Thoroughfare, Deal Island, Md.....	521	(1)
Warwick River, Md.....	10, 244	15
Wicomico River, Md. (Eastern Shore).....	434, 315	12, 923
Anacostia River, D.C.....	1, 377, 786	2, 756
Potomac River below Washington, D.C.....	3, 157, 927	222, 732
Potomac River tributaries.....	22, 608	46
Potomac River, Virginia Channel.....	578, 629	2, 720
Potomac River, Washington Channel, D.C.....	635	1
Appomattox River, Va. ²	-----	-----
Aquia Creek, Va.....	4	(1)
Atlantic Intracoastal Waterway between Norfolk, Va., and the St. Johns River, Fla. (net)---	3, 174, 147	719, 983
U.S. Army Engineer District, Norfolk:		
Via Dismal Swamp Canal Route.....	46, 754	1, 290
Via Great Bridge Lock Route.....	1, 056, 345	28, 733
U.S. Army Engineer District, Wilmington...	2, 033, 969	369, 620
U.S. Army Engineer District, Charleston...	1, 591, 064	206, 838
U.S. Army Engineer District, Savannah.....	1, 020, 283	97, 019
U.S. Army Engineer District, Jacksonville...	870, 888	15, 445
Blackwater River, Va.....	38, 588	521
Bransons Cove, Va.....	1, 651	(1)
Broad Creek, Va.....	961	(1)
Carter Creek, Va.....	57, 889	73
Channel connecting York River, Va., with Back Creek to Slaughter's Wharf.....	6, 041	6
Channel from Phoebus, Va., to deep water in Hampton Roads.....	1, 837	1
Channel to Newport News, Va.....	22, 366, 351	72, 691
Coan River, Va.....	8, 667	17
Cockrell Creek, Va.....	140, 654	211
Cranes Creek, Va.....	479	(1)
Davis Creek, Va.....	18, 983	9
Deep Creek, Accomac County, Va.....	560	(1)
Deep Creek, Warwick County, Va.....	19, 291	39
Dymers Creek, Va.....	34, 241	34
Hampton Creek, Va.....	419, 732	1, 175
Hoskins Creek, Va.....	9, 008	9
Jackson Creek, Va.....	203	(1)
James River, Va.....	5, 079, 937	320, 036
Kings Creek, Northampton County, Va.....	19, 100	19
Little Machipongo River, Va.....	35, 057	70
Little River (Creek), Va.....	53, 418	53
Little Wicomico River, Va.....	5, 637	11
Locklies Creek, Va.....	19, 169	29

See footnotes at end of table.

Table 28. Commerce on Project Waterways, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
Lower Machodoc Creek, Va.....	4, 390	7
Mattaponi River, Va.....	56, 061	1, 142
Milford Haven, Va.....	4, 652	5
Mill Creek, Va.....	1, 721	2
Mulberry Creek, Va.....	4, 511	2
Nandua Creek, Va.....	1, 699	7
Nansemond River, Va.....	412, 743	3, 426
Newport News Creek, Va.....	246, 239	98
Nomini Bay and Creek, Va.....	6, 136	18
Ocohanock Creek, Va.....	2, 515	10
Occoquan Creek, Va.....	103	(1)
Onancock River, Va.....	30, 642	169
Oyster Channel, Va.....	24, 653	22
Pagan River, Va.....	32, 637	131
Pamunkey River, Va.....	192, 811	289
Parrotts Creek, Va.....	7, 043	5
Quinby Creek, Va.....	6, 820	5
Rappahannock River, Va.....	469, 751	35, 107
Starlings Creek, Va.....	24, 794	15
Tangier Channel, Va.....	2, 704	4
Totuskey Creek, Va.....	26, 810	147
Upper Machodoc Creek, Va.....	96	(1)
Urbanna Creek, Va.....	16, 650	8
Waterway on coast of Virginia.....	104, 140	2, 447
Whitings Creek, Va.....	312	(1)
Willoughby Channel, Va. ²		
York River, Va.....	5, 185, 001	119, 255
Bay River, N.C.....	1, 757	21
Black River, N.C. ²		
Cape Fear River, N.C., above Wilmington.....	430, 214	31, 621
Cashie River, N.C.....	29, 350	602
Channel connecting Thoroughfare Bay with Cedar Bay, N.C.....	1, 125	5
Channel from Back Sound to Lookout Bight, N.C.....	810	3
Channel from Pamlico Sound to Avon, N.C.....	3, 251	3
Channel from Pamlico Sound to Rodanthe, N.C.....	425	(1)
Chowan River, N.C.....	77, 617	2, 941
Contentnea Creek, N.C. ²		
Drum Inlet, N.C.....	205	(1)
Far Creek, N.C.....	7, 662	15
Knobbs Creek, N.C.....	6, 981	4
Lockwoods Folly River, N.C.....	16	(1)
Mackay Creek, N.C.....	312	(1)
Meherrin River, N.C.....	6, 483	68
Neuse River, N.C.....	211, 115	2, 111

See footnotes at end of table.

Table 28. Commerce on Project Waterways, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
Northeast (Cape Fear) River, N.C.-----	3, 091	77
Pamlico and Tar Rivers, N.C.-----	67, 817	949
Perquimans River, N.C.-----	25, 778	284
Roanoke River, N.C.-----	430, 403	8, 810
Rollinson Channel, N.C.-----	5, 398	16
Scuppernong River, N.C.-----	4, 297	21
Shallotte River, N.C.-----	152	(1)
Smiths Creek (Pamlico County), N.C.-----	1, 105	1
Smiths Creek (Wilmington), N.C.-----	7, 267	7
South River, N.C.-----	370	1
Stumpy Point Bay, N.C.-----	635	1
Swift Creek, N.C. ² -----	-----	-----
Trent River, N.C.-----	56, 603	85
Waccamaw River, N.C., and S.C.-----	14, 471	601
Wallace Channel, Pamlico Sound, N.C.-----	8, 518	60
Waterway connecting Pamlico Sound and Beau- fort Harbor, N.C.-----	9, 814	177
Waterway connecting Swan Quarter Bay with Deep Bay, N.C.-----	866	3
Wilmington Harbor, N.C.-----	4, 826, 608	115, 599
Abbapoola Creek, S.C. ² -----	-----	-----
Ashley River, S.C.-----	14, 596	88
Beresford Creek, S.C. ² -----	-----	-----
Congaree River, S.C. ² -----	-----	-----
Great Pee Dee River, S.C.-----	10, 350	104
Mingo Creek, S.C. ² -----	-----	-----
Russell Creek, S.C. ² -----	-----	-----
Santee River, S.C.-----	4, 150	316
Shipyard River, S.C.-----	815, 425	815
Altamaha River, Ga.-----	20, 159	121
Apalachicola, Chattahoochee and Flint Rivers, Ga. and Fla.-----	339, 905	24, 050
Fancy Bluff Creek, Ga. ² -----	-----	-----
Ocmulgee River, Ga. ² -----	-----	-----
Oconee River, Ga. ² -----	-----	-----
St. Marys River, Ga., and Fla.-----	91, 832	551
Satilla River, Ga.-----	41, 745	1, 336
Savannah River below Augusta, Ga.-----	68, 906	13, 506
Anclote River, Fla.-----	2, 983	25
Bayou Chico, Fla.-----	82, 659	99
Blackwater River, Fla. ² -----	-----	-----
Channel from Naples, Fla., to Big Marco Pass, Fla.-----	27, 969	306
Choctawhatchee River, Fla., and Ala. ² -----	-----	-----
Courtenay Channel, Fla. ² -----	-----	-----
Crystal River, Fla.-----	150	1

See footnotes at end of table.

Table 28. Commerce on Project Waterways, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
East Pass Channel from the Gulf of Mexico into Choctawhatchee Bay, Fla.....	5, 381	5
Escambia and Conecuh Rivers, Fla. and Ala., Escambia Bay, Fla.....	125, 432	2, 846
Gulf County Canal, Fla.....	20, 178	112
Gulf Intracoastal Waterway between Apalachee Bay, Fla., and the Mexican border.....	46, 007, 718	7, 818, 576
Homosassa River, Fla.....	35	(1)
Horseshoe Cove, Fla.....	992	2
Hudson River, Fla. ²	-----	-----
Intracoastal Waterway, Caloosahatchee River to Anclote River, Fla.....	95, 592	1, 948
Intracoastal Waterway: Jacksonville to Miami, Fla.....	1, 314, 208	61, 082
Miami to Key West, Fla.....	668, 242	9, 678
Kissimmee River, Fla.....	255	1
La Grange Bayou, Fla.....	96, 558	386
Lake Crescent and Dunns Creek, Fla.....	68	(1)
Little Manatee River, Fla. ²	-----	-----
Manatee River, Fla.....	17, 813	36
Miami River, Fla.....	737, 948	2, 672
New River, Fla. ²	-----	-----
Okeechobee Waterway, Fla.....	92, 394	3, 082
Oklawaha River, Fla.....	109	1
Ozona, Fla., channel and turning basin.....	1, 085	(1)
Palm Beach, Fla., side channel and basin ²	-----	-----
Pithlachascotee River, Fla.....	81	(1)
Rice Creek, Fla.....	122, 760	405
St. Johns River, Fla., Jacksonville to Lake Harney.....	905, 294	67, 123
St. Lucie Inlet, Fla.....	279	1
St. Marks River, Fla.....	446, 513	3, 140
Steinhatchee River, Fla.....	650	3
Suwannee River, Fla.....	2, 388	12
Upper Chipola River, Fla., from mouth to Mariana ²	-----	-----
Watson Bayou, Fla.....	81, 905	101
Withlacoochee River, Fla.....	115, 999	1, 168
Alabama-Coosa Rivers, Ala. and Ga.....	437, 343	29, 640
Bayou Coden, Ala.....	1, 596	1
Bayou LaBatre, Ala.....	23, 392	58
Black Warrior, Warrior, and Tombigbee Rivers, Ala.....	5, 666, 203	1, 561, 667
Chickasaw Creek, Ala.....	662, 103	872
Three Mile Creek, Ala.....	3, 438, 304	1, 274
Waterway connecting the Tombigbee and Ten- nessee Rivers, Ala. and Miss. ²	-----	-----

See footnotes at end of table.

Table 28. *Commerce on Project Waterways, Calendar Year 1958—Continued*

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
Amite River and Bayou Manchac, La.....	10, 459	106
Atchafalaya River, La.....	4, 922, 033	538, 140
Atchafalaya River, La., Morgan City to Gulf of Mexico.....	2, 443, 707	74, 401
Barataria Bay, La.....	996, 312	25, 588
Bayou Bartholomew, La. and Ark. ²		
Bayou Bonfouca, La.....	8, 570	75
Bayou Dupre, La.....	5, 504	33
Bayou Grossetete, La.....	15, 947	155
Bayou Lacombe, La.....	102, 891	501
Bayou Lafourche, La.....	2, 146, 649	28, 967
Bayou Little Caillou, La.....	84, 358	1, 355
Bayou Plaquemine Brule, La. ²		
Bayou Queue de Tortue, La. ²		
Bayou Segnette, La.....	1, 737	11
Bayou Teche, La.....	402, 320	16, 470
Bayou Terrebonne, La.....	1, 463, 692	11, 629
Bayou Vermilion, La.....	419, 427	5, 569
Bayous D'Arbonne and Corney, La. ²		
Bayous La Loutre, St. Malo, and Yscloskey, La.....	14, 486	335
Big Pigeon and Little Pigeon Bayous, La.....	143, 075	1, 781
Boeuf River, La. ²		
Calcasieu River and Pass, La.....	15, 380, 324	324, 531
Chefunct and Bogue Falia Rivers, La.....	42, 859	123
Cypress Bayou and Waterway between Jefferson, Tex., and Shreveport, La.....	1, 055	9
Franklin Canal, La. ²		
Grand Bayou Pass, La. ²		
Gulf Intracoastal Waterway, Plaquemine to Morgan City Route, La.....	2, 876, 251	132, 876
Inland Waterway from Franklin to Mermentau River, La.....	426, 928	8, 462
Innerharbor Navigation Canal, La.....	6, 049, 025	20, 770
Johnsons Bayou, La.....	26, 889	134
Lake Charles Deep Water Channel, La.....	17, 199, 673	428, 272
Little River, La. ²		
Mermentau River, Bayou Nezpique and Bayou Des Cannes, La.....	2, 343, 625	64, 301
Pass Manchac, La.....	22, 397	157
Petit Anse, Tigre, and Carlin Bayous, La.....	696, 116	5, 108
Tensas River and Bayou Macon, La. ²		
Terrebonne Bay, La. ²		
Tickfaw, Natalbany, Ponchatoula, and Blood Rivers, La. ²		
Vinton Waterway, La.....	48, 891	489
Waterway from Empire, La., to Gulf of Mexico.....	395, 518	2, 611

See footnotes at end of table.

Table 28. Commerce on Project Waterways, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
Waterway from Intracoastal Waterway to Bayou Dulac, La. (Bayous Le Carpe and Grand Caillou)-----	397, 931	5, 000
Waterway from White Lake to Pecan Island, La.-----	14, 104	25
Bayou Bernard, Miss.-----	37, 483	134
Bayou Galere, Miss. ² -----		
Big Sunflower River, Miss. ² -----		
Bluff Creek, Miss.-----	2, 436	19
East Pearl River, Miss.-----	54, 797	677
Little Sunflower River, Miss. ² -----		
Mississippi River:		
Minneapolis, Minn., to mouth of Passes (net)-----	112, 578, 238	33, 281, 737
Minneapolis, Minn., to mouth of Missouri River-----	24, 393, 587	4, 447, 453
Mouth of Missouri River to mouth of Ohio River-----	25, 701, 271	3, 932, 665
Mouth of Ohio River to but not including Baton Rouge, La.-----	32, 806, 189	16, 052, 797
Baton Rouge, La., to but not including New Orleans, La.-----	47, 388, 594	3, 842, 097
New Orleans, La., to mouth of Passes-----	70, 430, 391	5, 006, 725
Mouth of Yazoo River, Miss.-----	302, 232	272
Pascagoula River, Miss.-----	2, 585	52
Pearl River, Miss., and La.-----	158, 437	6, 197
Steele and Washington Bayous and Lake Washington, Miss. ² -----		
Tallahatchie and Coldwater Rivers, Miss. ² -----		
Wolf and Jordan Rivers, Miss.-----	23, 883	272
Yazoo River, Miss.-----	10, 103	10
Anahuac Channel, Tex.-----	632, 977	3, 038
Bastrop Bayou, Tex.-----	17, 648	173
Brazos Island Harbor, Tex. (waterway)-----	1, 402, 110	17, 149
Cedar Bayou, Tex.-----	564, 868	4, 324
Channel from Pass Cavallo to Port Lavaca, Tex.-----	690, 257	12, 120
Channel to Aransas Pass, Tex.-----	79, 765	500
Channel to Palacios, Tex.-----	92, 272	1, 280
Channel to Port Bolivar, Tex.-----	5, 747	6
Channel to Rockport, Tex.-----	2, 598	6
Chocolate Bayou, Tex.-----	295, 239	4, 517
Clear Creek, Tex.-----	108, 398	587
Dickinson Bayou, Tex.-----	499, 285	4, 654
Double Bayou, Tex.-----	160, 997	350
Gaudalupe River to Victoria, Tex.-----	180, 457	2, 146
Port Aransas (Aransas Pass)—Corpus Christi Waterway, Tex.-----	21, 744, 814	384, 771

See footnotes at end of table.

Table 28. Commerce on Project Waterways, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
Port Mansfield, Tex. (tributary)-----	15, 196	21
Sabine-Neches Waterway, Tex-----	60, 674, 062	1, 419, 871
San Bernard River, Tex-----	1, 104, 901	26, 448
Tributary Arroyo Colorado, Tex-----	166, 881	4, 045
Trinity River, Channel to Liberty, Tex-----	597, 471	7, 235
Arkansas River, Ark. and Okla-----	676, 462	4, 407
Black River, Ark. and Mo. ² -----		
Ouachita and Black Rivers, Ark. and La-----	325, 221	74, 109
Ouachita River above Camden, Ark. ² -----		
Red River below Fulton, Ark-----	295, 265	8, 181
St. Francis and L'Anguille Rivers and Blackfish Bayou, Ark-----	430	13
Saline River, Ark. ² -----		
Upper White River, Ark-----	26, 700	134
White River, Ark., below Batesville, Ark-----	140, 703	5, 096
Cumberland River, mouth to Burnside, Ky. (net)-----	2, 858, 665	378, 992
Mouth to Nashville, Tenn-----	2, 858, 665	378, 399
Nashville, Tenn., to Burnside, Ky-----	21, 508	593
French Broad and Little Pigeon Rivers, Tenn-----	24, 910	216
Tennessee River, Tenn., Ala., and Ky-----	12, 040, 826	2, 103, 256
Wolf River, Tenn-----	1, 084, 012	1, 886
Missouri River:		
Fort Benton to the mouth (net)-----	5, 222, 626	267, 018
Kansas City to the mouth-----	2, 581, 271	229, 866
Sioux City to Kansas City-----	2, 771, 414	35, 937
Fort Benton to Sioux City-----	182, 357	1, 216
Muskingum River, Ohio-----	47, 742	10
Ohio River, Pittsburgh to mouth-----	73, 476, 894	15, 891, 978
Big Sandy River, Tug and Levisa Forks, Ky. and W. Va-----	118, 073	472
Green and Barren Rivers, Ky-----	4, 794, 960	409, 978
Kentucky River, Ky-----	317, 198	23, 532
Rough River, Ky. ² -----		
Tradewater River, Ky-----	100, 983	303
Kanawha River, W. Va-----	8, 213, 144	440, 698
Little Kanawha River, W. Va-----	132, 208	348
Allegheny River, Pa., improved portion-----	4, 551, 291	71, 225
Allegheny River, Pa., open channel portion-----	121, 600	122
Monongahela River, Pa. and W. Va-----	28, 911, 161	1, 416, 739
Youghiogheny River, Pa-----	90, 636	18
Minnesota River, Minn-----	1, 236, 367	14, 834
Big Suamico River, Wis-----	250	(³)
Black River, Wis-----	343, 482	312
Fox River, Wis-----	63, 099	1, 262
Sturgeon Bay and Lake Michigan Ship Canal, Wis-----	1, 047, 920	(³)

See footnotes at end of table.

Table 28. Commerce on Project Waterways, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
St. Croix River, Wis. and Minn.-----	26, 891	616
Channels in Lake St. Clair, Mich.-----	76, 661, 223	(5)
Clinton River, Mich. ² -----		
Detroit River, Mich.-----	87, 878, 763	2, 421, 814
Grand River, Mich.-----	1, 500, 025	(3)
Grays Reef Passage, Mich.-----	4, 594, 974	(3)
Keweenaw Waterway, Mich.-----	566, 911	(3)
Rouge River, Mich.-----	9, 403, 160	(3)
Saginaw River, Mich.-----	4, 309, 886	(3)
St. Clair River, Mich.-----	77, 436, 861	4, 349, 133
St. Joseph River, Mich.-----	40, 625	284
St. Marys Falls Canal, Mich. (American Canal)---	75, 093, 756	(3)
St. Marys River, Mich.-----	79, 588, 107	4, 236, 622
Calumet-Sag Channel, Ill.-----	6, 005, 039	125, 315
Chicago River (Main and North Branch, Ill.)-----	3, 581, 761	4, 289
Chicago River, South Branch, Ill.-----	5, 299, 803	19, 531
Chicago Sanitary and Ship Canal, Ill.-----	19, 359, 795	355, 233
Illinois and Mississippi Canal, Ill. ² -----		
Illinois River, Ill.-----	20, 562, 464	4, 257, 865
Lake Calumet, Ill.-----	742, 523	(3)
Middle River and connecting channels, Calif.-----	28, 155	147
Mokelumne River, Calif.-----	22, 123	177
Napa River, Calif.-----	82, 629	1, 281
Noyo River, Calif.-----	5, 091	6
Old River, Calif.-----	212, 141	5, 163
Petaluma Creek, Calif.-----	301, 554	5, 880
Sacramento River, Calif.-----	2, 259, 495	131, 949
San Joaquin River, Calif.-----	3, 941, 547	140, 844
San Pablo Bay and Mare Island Strait, Calif.-----	16, 819, 858	(3)
San Rafael Creek, Calif.-----	104, 141	364
Suisun Bay Channel, Calif.-----	8, 762, 449	74, 842
Suisun Channel, Calif.-----	140, 387	1, 825
Canals and Locks at Willamette Falls, Oreg.-----	957, 694	287
Clatskanie River, Oreg.-----	22, 566	79
Columbia River:		
Mouth to International Boundary (net)-----	17, 600, 871	1, 441, 790
At Baker Bay, Wash.-----	6, 893	34
Columbia and Lower Willamette Rivers be-		
low Vancouver, Wash., and Portland, Oreg.-----	18, 469, 720	1, 231, 921
At Bonneville, Oreg.-----	1, 702, 752	1, 703
At McNary Lock and Dam, Oreg. and Wash.-----	945, 693	757
Between Wenatchee and Kettle Falls, Wash.-----	212, 204	5, 543
Vancouver, Wash., to The Dalles, Oreg.-----	3, 162, 845	120, 730
The Dalles Dam, Oreg. and Wash.-----	1, 313, 579	171
Columbia River and tributaries above the		
Dalles Dam to McNary Lock and Dam,		
Oreg. and Wash.-----	1, 307, 645	125, 361

See footnotes at end of table.

Table 28. Commerce on Project Waterways, Calendar Year 1958—Continued

[In tons of 2,000 pounds]

Waterway	Tons	Total ton-miles (000 omitted)
Columbia River—Continued		
Columbia River and tributaries above McNary Lock and Dam to Kennewick, Wash.-----	946, 545	29, 836
Columbia Slough, Oreg.-----	5, 752	32
Coos and Millicoma Rivers, Oreg.-----	828, 577	3, 729
Coquille River, Oreg.-----	354, 306	3, 366
Coquille River, Oreg. (entrance)-----	277, 362	307
Multnomah Channel, Oreg.-----	717, 250	4, 304
Nehalem Bay, Oreg. ² -----		
Rogue River, Oreg.-----	13, 259	345
Siuslaw River, Oreg.-----	370, 796	2, 596
Skipanon Channel, Oreg.-----	105, 641	167
Smith River, Oreg.-----	256, 396	1, 538
Snake River, Oreg., Wash., and Idaho-----	417, 885	729
Umpqua River, Oreg.-----	928, 919	10, 218
Westport Slough, Oreg.-----	110, 569	77
Willamette River above Portland and Yamhill River, Oreg.-----	3, 373, 754	50, 083
Yaquina River, Oreg.-----	587, 017	5, 283
Youngs Bay and Youngs River, Oreg.-----	711, 842	2, 491
Kootenai River, Idaho and Mont. ² -----		
Chinook Channel, Wash.-----	5, 229	4
Cowlitz River, Wash.-----	123, 592	536
Deep River, Wash.-----	470, 204	2, 201
Elokomin Slough, Wash.-----	145, 299	145
Grays River, Wash.-----	138	1
Hoquiam River, Wash.-----	471, 468	3, 772
Lake River, Wash.-----	14, 341	36
Lake Washington Ship Canal, Wash.-----	1, 740, 328	(³)
Lewis River, Wash.-----	92, 770	605
Quillayute River, Wash.-----	781	1
Skagit River, Wash.-----	62, 230	685
Skamokawa Creek, Wash.-----	934	(¹)
Skamokawa Slough, Wash.-----	4, 828	1
Stillaguamish River, Wash.-----	4, 459	27
Swinomish Slough, Wash.-----	359, 247	3, 592
Waterway connecting Port Townsend and Oak Bay, Wash.-----	383, 835	345
Gastineau Channel, Alaska ² -----		
Wrangell Narrows, Alaska-----	244, 596	(³)

¹ Less than 500 ton-miles.² No commerce reported.³ Ton-miles not reported.⁴ Included in Delaware River, Philadelphia, Pa., to the sea.⁵ Included in St. Clair River.